Forest Service

Final Environmental Impact Statement

Chester County Stream and Riparian Restoration / Enhancement Project

November 19, 2014

Enoree Ranger District of
Sumter National Forest
Chester County, South Carolina

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CHESTER COUNTY STREAM AND RIPARIAN RESTORATION/ENHANCEMENT PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT CHESTER COUNTY, SOUTH CAROLINA

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Abstract: The objective of the Chester County Stream and Riparian Restoration/Enhancement Project (Project) is to restore and enhance the hydrologic and aquatic functions on approximately 18 miles of streams within four watersheds within the Enoree Ranger District of Sumter National Forest (Project Area): McCluney Branch, Little Turkey Creek, Clarks Creek, and an unnamed tributary to Clarks Creek. This change in condition would restore riparian functions and help re-establish stability of the stream systems and natural habitat-forming processes. This may include, but is not limited to, restoring the hydrologic regime including reconnecting streams to their respective floodplains, reducing sedimentation and stabilizing banks, improving in-stream and riparian habitats, and improving water quality.

The Enoree Ranger District is geographically located within the Lower Broad, Enoree and Tyger River sub-basins (8-digit Hydrologic Unit Code [HUC]). The Project is officially contained within the Lower Broad River Subbasin, Browns Creek-Broad River watershed, and Hughes Creek-Broad River subwatershed. The Compensatory Mitigation Rule clarifies that public lands are appropriate for use in completion of compensatory mitigation projects, provided a land management plan is in place to enable long-term protection and management of the mitigation property. The U.S. Forest Service (Forest Service) and U.S. Army Corps of Engineers (USACE) have entered into a Conservation Land Use Agreement (2013) “whereby compensatory mitigation requirements associated with Department of the Army (DA) permits may be used: (1) to restore or enhance aquatic resources located on suitable lands comprising the National Forest System; and/or (2) to contribute suitable lands to be incorporated within the National Forest System.” The USACE is also a cooperating agency with the Forest Service in preparing this Final Environmental Impact Statement (EIS). This Final EIS discloses the direct, indirect, and cumulative impacts of the alternatives and provides the required documentation so the watersheds may be considered for future use as compensatory mitigation properties.

Two alternatives were evaluated in detail:

Alternative 1-No Action
Alternative 2-Proposed Action

SUMMARY

I. Introduction

The U.S. Forest Service (Forest Service) proposes to restore and enhance the hydrologic and aquatic functions on approximately 18 miles of streams in four watersheds within the Enoree Ranger District of Sumter National Forest (Project Area). This change in condition would restore riparian functions and help to re-establish stability of the stream systems and natural habitat-forming processes. Changes include, but are not limited to, restoring the hydrologic regime by reconnecting streams to their respective floodplains, reducing sedimentation and stabilizing banks, improving in-stream and riparian habitats, and improving water quality.

The four watersheds (Clarks Creek, Little Turkey Creek, McCluney Branch, and an unnamed tributary to Clarks Creek) are located in the westernmost portion of Chester County, South Carolina, approximately 2 miles south of Lockhart.

Three types of restoration approaches are proposed: P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches. A restoration approach is proposed for each stream segment based on the conditions of individual streams and floodplains, and a combination of approaches is typically proposed within an individual watershed to meet site conditions.

II. Purpose and Need for Action

The purpose and need for the Chester County Stream and Riparian Restoration/Enhancement Project (Project) is to restore and enhance the hydrologic and aquatic functions within four watersheds located upon lands of the Sumter National Forest in Chester County, South Carolina. Hereinafter this Final Environmental Impact Statement (EIS) uses the word "restore" synonymously with "rehabilitate."

Stream restoration is a primary goal of the Forest Service's 2004 Revised Land and Resource Management Plan, Sumter National Forest (Forest Plan), which includes multiple objectives designed to restore and enhance stream habitat and aquatic communities within the Project Area streams. The Forest Service and the U.S. Army Corps of Engineers (USACE) have entered into a regional Conservation Land Use Agreement that sets forth the policies, undertakings, and responsibilities governing the use of Sumter National Forest lands for compensatory mitigation projects required or authorized under the USACE's permit program.

In May 2011, the Forest Service began discussions with the USACE and Duke Energy Carolinas, LLC (Duke Energy) regarding the potential for undertaking a compensatory mitigation project on the Enoree Ranger District. The Project would serve to offset impacts associated with the construction of Duke Energy's construction of a drought and operating contingency reservoir for the proposed William States Lee III Nuclear Station (Lee Nuclear Station) in Cherokee County, South Carolina.

By later dated August 6, 2014, the USACE agreed to be a cooperating agency with the Forest Service in preparing this Final EIS for the Project. The USACE noted that the agency would be actively involved in the NEPA process as well as the contents of the document in order for the Final EIS to meet USACE regulatory needs under NEPA, the Clean Water Act, and 33 Code of Federal Regulations (CFR) Parts 330-332 (See Appendix A). The USACE reviewed and provided comments to the Forest Service on the Draft and Final EIS prior to public distribution. All comments from the USACE were incorporated into this Final EIS.

Existing Condition

The Project Area is bounded by the Broad River to the west and Highway SC-49 to the east. Sediment covers the Piedmont stream valleys in varying depths up to several meters and has inundated once pristine stream and wetland systems. Streams within the Project Area reflect past land management practices that led to deteriorated conditions and reduced stream function. Streams are incised and disconnected from an active floodplain, which exacerbates in-stream channel erosion and down-cutting and substantially limits the hydrologic, physical, chemical, and biological functions of a stream that has access to its floodplain (USFS 2004).

Desired Condition

Eighteen miles of restored stream would result in improved riparian functions. Changes include, but not limited to, restoring the hydrologic regime by reconnecting streams to their respective floodplains, reducing sedimentation and stabilizing banks, improving in-stream and riparian habitats, and improving water quality.

III. Public Involvement and Identification of Issues

On April 18, 2014, the Forest Service distributed a Scoping Letter / Notice of Intent (NOI) to 70 individuals, State, Federal, and local agencies and organizations, informing them of the intent to prepare an EIS and inviting comments for developing action alternatives.

On April 23, 2014, the NOI was published in the Federal Register / 79 FR 22618, with a deadline for scoping comments to be received by May 23, 2014. On April 28, 2014, the Forest Service hosted a Scoping Meeting at the Chester County Community Center, Chester, South Carolina. Twelve individuals attended the Scoping Meeting, during which two individuals provided statements to the court reporter. The Forest Service received one individual letter from the South Carolina Department of Natural Resources (SCDNR).

The Notice of Availability of the Draft EIS was published in the 79 FR No. 177, September 12, 2014/Notices, pages 54707 and 54708. A notification letter dated September 4, 2014 was sent or emailed to all those who responded during the scoping period making them aware that the Draft EIS was available for review. The document was posted on the Francis Marion and Sumter National Forest Web pages at the same time the notification letter was sent. A legal notice was published in the paper of record, *The State*, South Carolina on September 16, 2014, providing notice of availability of the Draft EIS. Appendix D of the EIS contains a detailed account of the comments received during the Draft EIS comment period, along with the Forest Service's responses to those comments.

IV. Alternatives Considered in Detail

Alternative 1-No Action

Alternative 1-No Action provides a baseline against which impacts of the action alternatives can be measured and compared. Under this alternative, none of the specific stream restoration activities would occur in the four watersheds. On-going activities such as recreation, maintenance of wildlife openings, timbering, and other forest management activities would continue. Stream stability would continue to deteriorate and channel erosion would continue.

Alternative 2-Proposed Action

Alternative 2-Proposed Action responds to the purpose and need for the Project. This alternative consists of restoring approximately 18 miles of streams in four watersheds in a variety of methods to return natural channel form, floodplain function, and habitat conditions. Stream restoration would include planting native tree, shrub, and herbaceous vegetation to help stabilize the stream banks and adjacent areas, and provide habitat improvements. Mitigation measures would be chosen to accelerate recovery and stabilization rates to limit erosion and quickly restore native forest and vegetation types to areas temporarily disturbed by restoration activities.

Restoration would involve earthmoving and shaping of the channel and floodplain. Connected actions include system road maintenance, temporary roads and bridges (including possible bridge replacements), soil borrow and fill areas, and timber harvesting.

This Project is consistent with the Forest Plan but requires a Forest Plan Amendment, described in Section 2.2.3.

Proposed Management Activities by Alternative

Table S-1 shows the proposed management activities by alternative.

TABLE S-1: SUMMARY OF PROPOSED STREAM RESTORATION APPROACHES FOR ALL ALTERNATIVES

Activities	**Alternative 1 No Action** (miles)	**Alternative 2 Proposed Action** (miles*)
P1 Floodplain Reconnection	0	8.1
P1 Transition to P2	0	2.0
P2 Floodplain Excavation	0	1.9
P2 to P1 Transition	0	2.5
P3 Floodplain Benches	0	3.3
No Restoration	0	0.2
Total *All distances are approximate	0	18

V. Environmental Consequences

Chapter 3 of this Final EIS identifies impacts to the physical, biological, and social environment. The Forest Plan provides overall management direction and standards to follow to reduce adverse effects to forest resources.

These subject areas were evaluated for direct, indirect, and cumulative effects:

- Soils
- Water, Riparian Areas, Wetlands, and Floodplains
- Air
- Climate Change and Carbon Storage
- Roads and Bridges
- Vegetation, Ecological Communities and Non-Native Invasive Species (NNIS)
- Wildlife
- Migratory Birds
- Aquatic Communities
- Cultural Resources
- Scenery and Recreation
- Economics
- Human Health and Safety
- Environmental Justice and the Protection of Children
- Civil Rights
- Other Environmental Disclosures

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

1.1 DOCUMENT STRUCTURE

The U.S. Forest Service (Forest Service) prepared this Final Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Final EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and no-action alternatives. The document is organized into four chapters:

Chapter 1. Purpose and Need for Action

The history of the proposed Chester County Stream and Riparian Restoration/Enhancement Project (Project), purpose of and need for the Project, and the Forest Service's proposal for achieving that purpose and need are detailed in this chapter. The Forest Service's public involvement, scoping procedures, public comments and identification of issues related to implementation of the Project are also provided.

Chapter 2. Alternatives, including the Proposed Action

A more detailed description of the Forest Service's proposed action as well as alternative methods for achieving the stated purpose are detailed in this chapter. Alternatives were developed based on significant issues raised by the public and other agencies. Also included are mitigation measures along with a summary table of the environmental consequences associated with each alternative.

Chapter 3. Affected Environment and Environmental Consequences

Description of the direct, indirect, and cumulative environmental effects of implementing the proposed action and other alternatives are provided in this chapter.

Chapter 4. Consultation and Coordination

A list of preparers and agencies consulted during the development of the Final EIS are provided in this chapter.

Appendices

More detailed information to support the analyses presented in the Final EIS are located in the appendices.

Additional documentation may be found in the Project documents located at:
http://www.sumterstreamrestorationproject.com and
http://www.fs.fed.us/nepa/nepa_project_exp.php?project=44310.

1.2 PURPOSE AND NEED FOR ACTION

The purpose and need for this Project is to restore and enhance the hydrologic and aquatic functions within four watersheds (Project Area) located upon lands of the Sumter National Forest in Chester County, South Carolina. This change in condition would restore (restore and rehabilitate are used synonymously in this Final EIS) riparian functions and help move the current stream systems toward stability and reestablishment of natural stream and related habitat forming processes. This may include, but not be limited to, restoring the hydrologic

regime including reconnecting streams to their respective floodplains, reducing sedimentation and stabilizing banks, improving instream and riparian habitats, and improving water quality.

In 2010, the United States Army Corps of Engineers (USACE) approached the Forest Service regarding the potential for completing compensatory mitigation projects upon National Forest System lands. The USACE Final Mitigation Rule (the Rule) requires that compensatory mitigation be completed within or immediately adjacent to the watershed where the impacts are occurring. The Enoree Ranger District is geographically located within the Lower Broad, Enoree and Tyger sub-basins (8-digit Hydrologic Unit Code [HUC]), making it within the primary service area for projects in Greenville, Spartanburg and possibly the greater Charlotte metro area. The Rule clarifies that public lands are appropriate for use in completion of compensatory mitigation projects, provided a land management plan is in place to enable long-term protection and management of the mitigation property.

By letter dated August 6, 2014, the USACE agreed to be a cooperating agency with the Forest Service in preparing this Final EIS for the Project. The USACE noted that the agency would be actively involved in the NEPA process as well as the contents of the document in order for the Final EIS to meet USACE regulatory needs under NEPA, the Clean Water Act, and 33 Code of Federal Regulations (CFR) Parts 330-332 (Appendix A). The USACE reviewed and provided comments to the Forest Service on the Draft and Final EIS prior to public distribution. All comments from the USACE were incorporated into this Final EIS.

Stream restoration is a primary goal of the Forest Service's 2004 Revised Land and Resource Management Plan, Sumter National Forest (Forest Plan) and includes multiple objectives designed to restore and enhance stream habitat and aquatic communities within the Project Area streams.[1] The Forest Service and USACE entered into a regional Conservation Land Use Agreement that sets forth the policies, undertakings, and responsibilities governing the use of Sumter National Forest lands for compensatory mitigation projects required or authorized under USACE's permit program.

In May 2011, the Forest Service began discussions with the USACE and Duke Energy Carolinas, LLC (Duke Energy) regarding the potential for a compensatory mitigation project to be completed on the Enoree Ranger District. The Project would serve to offset the impacts associated with Duke Energy's construction of a drought and operating contingency reservoir for the proposed William States Lee III Nuclear Station (Lee Nuclear Station) in Cherokee County, South Carolina.

It is the intent of this Final EIS to identify those watersheds within the analysis area that may benefit from restoration and enhancement, and to provide the required documentation so that they may be considered for future use as compensatory mitigation properties.

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[1] Goal 11, Objective 2 (U.S. Forest Service Revised Land and Resource Management Plan) - Restore and enhance stream habitat and aquatic communities in 50 miles of streams. This includes woody debris, stream bank stabilization, and in stream habitat improvement.

1.3 BACKGROUND

The Project Area (11,605 acres) is located along the western-most portion of Chester County, South Carolina, approximately 2 miles south of Lockhart (Figure 1-1). The Project Area is bounded by the Broad River to the west and Highway SC-49 to the east. The potential restoration work to be completed within the Project Area includes approximately 18 miles of streams within four watersheds: Clarks Creek, Little Turkey Creek, McCluney Branch, and an unnamed tributary to Clarks Creek.

Native Americans moved into the Broad River valley approximately 12,000 years ago. Their populations remained relatively small throughout their occupation, and their effect on the environment was limited. The small groups of European settlers who first moved into the Project Area in the 1750s were primarily farmers who cultivated level terrain along the major streams and rivers. An influx of settlement followed the American Revolution, and these settlers moved into the uplands. Cotton agriculture started in the early 1800s, and cotton remained the main staple crop in the Piedmont until the early 1900s. Extensive tracts of erosion-prone land were cleared for cultivation. Fields that were allowed to lay fallow after the growing season were soon subjected to sheet erosion, which quickly produced gullies. When federal acquisition began in the 1930s, the South Carolina Piedmont was one of the most severely eroded regions in the United States (Benson 2006 as cited in Brockington 2013). Sediment covers Piedmont stream valleys in varying depths up to several meters and has inundated once pristine stream and wetland systems (Duke Energy 2012).

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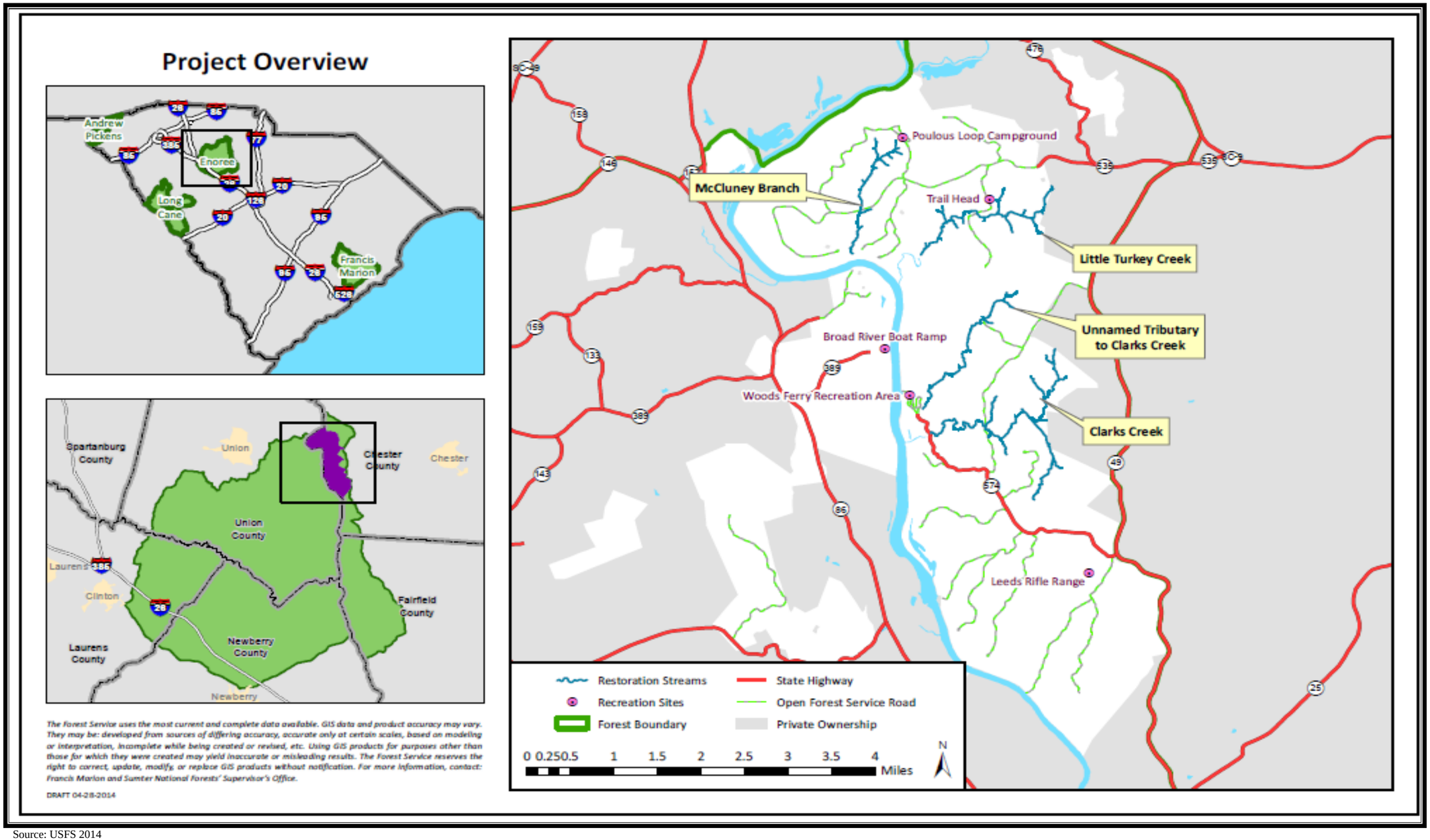

Source: USFS 2014
Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

FIGURE 1-1: PROJECT AREA AND VICINITY MAP

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The condition of streams within the Project Area reflects past land uses and management practices that led to deeply incised streambeds (Figure 1-2), reduced floodplain interactions, and worsening degradation of water quality and aquatic habitat (USFS 2004). Incised streambeds that are disconnected from an active floodplain exacerbate in-stream channel erosion and down-cutting and substantially limit the hydrologic, physical, chemical, and biological function typical of a stream that has access to its floodplain.

FIGURE 1-2: TYPICAL IMPACTED STREAM IN THE PROJECT AREA

1.4 FOREST GOALS AND OBJECTIVES

This proposal is consistent with the Forest Plan that provides goals and objectives for the Project Area. Restoring and enhancing the historic hydrologic and aquatic functions in the Project Area would help meet the following goals and objectives in the Forest Plan.

Goal 1

Watersheds are managed (and where necessary restored) to provide resilient and stable conditions to ensure the quality and quantity of water necessary to protect ecological functions and support intended beneficial water uses.

Objective 1.01
Improve soil and water conditions on 1,500 acres through stabilization or rehabilitation of actively eroding areas such as gullies, barren areas, abandoned roads or trails, and unstable stream banks over the 10-year planning period.

Goal 2
Manage in-stream flows and water levels, by working with other agencies if possible, to protect stream processes, aquatic and riparian habitats and communities, and recreation and aesthetic values.

Objective 2.01
The in-stream flows needed to protect stream processes, aquatic and riparian habitats and communities, and recreation and aesthetic values will be determined on 50 streams.

Goal 3
Riparian ecosystems, wetlands, and aquatic systems are managed (and where necessary restored) to protect and maintain their physical, chemical, and biological integrity.

Goal 4
Maintain or restore natural aquatic and riparian communities or habitat conditions in amounts, arrangements, and conditions to provide suitable habitats for riparian dependent and migratory species, especially aquatic species including fish, amphibians, and water birds within the planning area. Perennial and intermittent streams are managed in a manner that emphasizes and recruits large woody debris.

Objective 4.01
Create and maintain dense understory of native vegetation on 1-5 percent of the total riparian corridor acreage during the 10-year planning period.

Goal 6
Cooperate with landowners and other partners to address watershed needs and participate in efforts to identify stream problems, watershed planning, best management practices (BMPs), and total maximum daily load (TMDL) implementation with the South Carolina Department of Health and Environmental Control (SCDHEC), South Carolina Forestry Commission (SCFC) and other agencies.

Goal 9
Provide habitats to sustain the diversity and distribution of resident reptile and amphibian species as well as breeding, wintering, and migration staging and stopover habitat for migratory birds in ways that contributes to their long-term conservation.

11 Objective 2
Restore and enhance stream habitat and aquatic communities in 50 miles of streams. This includes woody debris, stream bank stabilization, brook trout restoration, and in stream habitat improvement.

Goal 14
Manage forest ecosystems and associated communities to maintain or restore composition, structure, function, and productivity over time.

1.5 DECISION FRAMEWORK

The Responsible Official for this decision is the Forest Supervisor, Francis Marion and Sumter National Forests. The Responsible Official can:

- Select the no action alternative;
- Select an action alternative that has been considered in detail;
- Modify an action alternative;
- Identify what mitigation and monitoring measures are required; or
- Suspend all further action or direct that other actions be pursued.

1.6 PUBLIC INVOLVEMENT

On April 23, 2014, the Notice of Intent (NOI) was published in the Federal Register (FR) 79 FR 22618, with a deadline for scoping comments to be received by May 23, 2014. Scoping letters were mailed to individuals, and public and private entities based on a district-wide mailing list generated from a public sensing meeting held on February 27, 2014. On April 28, 2014, the Forest Service hosted a scoping meeting at the Chester County Community Center, Chester, South Carolina. Twelve individuals attended the scoping meeting, and two individuals provided oral statements to the court reporter. The Enoree Ranger District received one individual letter from the South Carolina Department of Natural Resources.

The Draft EIS Notice of Availability was published in the FR Vol. 79 No. 177, September 12, 2014/Notices, pages 54707 and 54708. A notification letter dated September 4, 2014 was sent or emailed to all those who responded during the scoping period making them aware that the Draft EIS was available for review. The Draft EIS was posted on the Francis Marion and Sumter National Forest Web page at the same time the notification was sent. A legal notice was published in the paper of record, *The State*, South Carolina on September 16, 2014, providing notice of availability of the Draft EIS. Appendix D of the Final EIS contains a detailed account of the comments received during the Draft EIS comment period, along with the Forest Service's responses to those comments.

1.7 ISSUES

The Forest Service Interdisciplinary Team (IDT) reviewed all public comments received during the scoping period and categorized the comments as significant and non-significant issues. Significant issues were used to identify other alternatives, mitigation measures or to help frame the effects analysis in Chapter 3 of the Final EIS. Non-significant issues are those not relevant to the proposal or that represent an opinion. Content analysis of the public comments can be found in the Project file (*2014 Scoping Comments*).

No significant issues were identified that resulted in developing additional action alternatives. Draft EIS comments and responses are recorded in Appendix D.

SIGNIFICANT ISSUES USED TO FRAME THE EFFECTS ANALYSIS AND TO DEVELOP MITIGATION MEASURES

Issue 1-Use of Trails for Horseback Riding during Construction

Comment: Concern was raised by the public regarding the Project's effect on horseback riding activities during restoration. Specifically, horseback riders were concerned that all streams would be restored at the same time which would effectively cause riders to relocate to other recreation areas. Further, riders are concerned with the horse trail crossings (hardening those sites to protect vegetation and horses), access to water for horses, and how the Forest Service intends to communicate the Project schedule.

Response

This issue is addressed in Chapter 3 in the recreation section of this Final EIS. Mitigation measures have been developed to reduce or eliminate adverse effects and are included in Section 2.4. It is likely that the Project would be implemented over a four year period to avoid closing all trails at the same time. The Project would be monitored to assure mitigation measures are effective at reducing adverse effects. Forest Plan standards and any associated BMPs would be implemented during Project implementation. Mitigation measures are included with the proposal to reduce or eliminate adverse effects.

Issue 2-Construction Disturbance of Existing Aquatic Community

Comment: Construction disturbance related to implementing Alternative 2-Proposed Action (i.e. dewatering, substrate disturbance, and increased turbidity) would extirpate the aquatic community until they are able to re-colonize or are restocked in restored streams. Existing instream habitat and cover would be lost.

Response

This issue has been addressed in Section 3.11, Aquatic Communities. Mitigation measures have been developed to reduce or eliminate adverse effects and are included in Chapter 2.

Substrate features (course substrate, gravel bars, large wood, and rock) would be incorporated into final design. Vernal pools would be created in the new floodplain. Biological protocol assessments contained in the Forest Plan would be implemented during the monitoring phase.

Issue 3-Non-Native Invasive Species

Comment: Need to prevent or minimize the introduction and spread of non-native invasive species (NNIS) plants within the Project Area during and following restoration.

Response

This issue has been addressed in Chapter 3. Mitigation measures have been developed to reduce or eliminate adverse effects and are included in Chapter 2.

Treat NNIS plant populations occurring within areas proposed for stream restoration, treating them both prior to initiation of stream restoration, and including follow-up NNIS treatments as needed. Include entire extent of the NNIS plant population in the stream restoration area.

The Sumter National Forest has a forest-wide decision in place to treat NNIS plant populations using herbicides.

Issue 4-Loss of Overhead Cover would Result in Increases in Water Temperature
Comment: The loss of overhead vegetative/tree cover and associated shading during construction would have a short-term adverse impact on aquatic species due to an increase in water temperature.

Response
This issue has been addressed in Sections 3.7, Vegetation Communities and 3.11, Aquatic Communities. Mitigation measures developed to reduce or eliminate adverse effects are included in Chapter 2.

Restoration areas will be replanted with fast-growing, native plant species. These species will be managed to accelerate plant community succession.

Issue 4-Floodplain Restoration Could Reduce Stream Flow Water Yield Temporarily until Soils Become Hydrated
Comment: Floodplain restoration design and construction activities could reduce stream flow water yield temporarily. Effects could be associated with restoration design (expanding the floodplain, diverting the stream channel) or construction activities (pumping water around the restoration area to limit sedimentation and erosion).

Response
This issue has been addressed in Section 3.7.5, Aquatic Communities. Mitigation measures have been developed to reduce or eliminate adverse effects and are included in Chapter 2. There may be some hillslope or headwater gully channels that are currently capturing groundwater that will have reduced flow after restoration and these channels will be restored to their historic flow pattern as ephemeral or intermittent channels.

Forest Plan standards and any associated BMPs would be implemented during Project implementation. Mitigation measures included with proposal to reduce or eliminate adverse effects.

Issue 5-Aquatic Organism Passage Restrictions from Construction
Comment: Implementing Alternative 2-Proposed Action could result in increased sediment deposition from construction that may temporarily restrict passage of aquatic organisms at stream mouths.

Response
This issue has been addressed in Section 3.11, Aquatic Communities. Mitigation measures have been developed to reduce or eliminate adverse effects and are included in Chapter 2.

Forest Plan standards and any associated BMPs would be implemented during Project implementation. Stream channel morphology would be monitored for an increase in delta from existing conditions.

Issue 9-Wildlife
Comment: Concern was expressed that the proposal would have impacts on wildlife including threatened and endangered species.

Response
The effects of Alternative 2-Proposed Action on wildlife will be disclosed in the Biological Evaluation and the EIS. The US Fish and Wildlife Service (USFWS) will be consulted on this Project concerning impacts to federally listed species. Mitigation measures would be included to reduce adverse impacts to federally listed species. Management Indicator Species (MIS) and Migratory Birds have been evaluated in Chapter 3.

These issues have been addressed in Chapter 3. Mitigation measures have been developed to reduce or eliminate adverse impacts. The Forest Service received one agency comment that was considered but not analyzed in the Final EIS.

Issues Raised but not analyzed in the Final Environmental Impact Statement

Issue 1-Development of a Mitigation Bank
Comment: The South Carolina Department of Natural Resources (SCDNR) submitted comments on May 23, 2014 regarding the use of the Project as "compensatory mitigation for other projects in Greenville and Spartanburg". The Forest Service does not intend to set up a mitigation bank in accordance with USACE regulations. The proposed Project is not part of a mitigation bank but may be used to provide stream credits under the USACE's regulations; however, should Duke Energy not develop the Lee Nuclear Station and thus not require stream credits, the Project would move forward as Forest Service funding becomes available. Because developing a mitigation bank is not part of the Forest Service's alternatives addressed in this Final EIS, this issue was not further analyzed in Chapter 3.

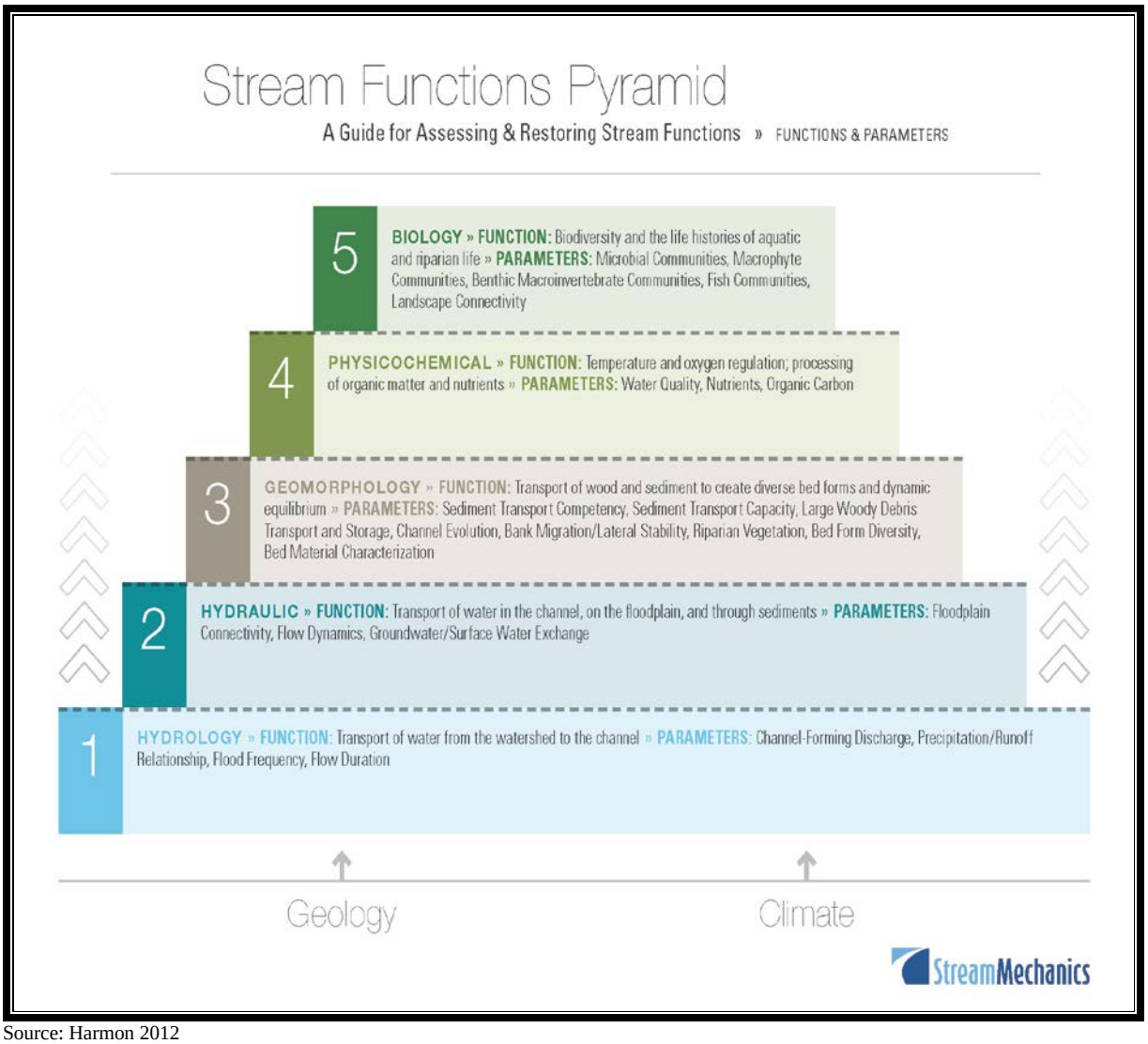
CHAPTER 2. ALTERNATIVES

2.1 INTRODUCTION

The Forest Service developed alternatives based on the Project purpose and need and the goals and objectives identified in the Forest Plan. Alternative 1-No Action and Alternative 2-Proposed Action are described and compared in this chapter. The Forest Service considered three additional alternatives that are not analyzed further in this Final EIS, as discussed in Section 2.3.

The Forest Service used the Stream Functions Pyramid (Figure 2-1) (Harman et al. 2012) as a tool for evaluating current stream functions and the potential improvement (i.e., lift) in stream function following restoration. All streams support a variety of physical, chemical, and biological processes (i.e., functions). The Stream Functions Pyramid (Figure 2-1) presents the functions in 5 levels. The Stream Functions Pyramid is based on the premises that lower-level functions support higher-level functions and that local geology and climate influence all functions. The functions are closely related, and cause-and-effect relationships move up and down the Stream Functions Pyramid. When a stream that is functioning at the hydrology level is restored and now functions at the physiochemical level, the stream has experienced "functional lift."

During the process of developing alternatives, the hierarchical structure of the Stream Functions Pyramid provided a conceptual framework for identifying the functions that can be improved in each stream and how best to restore those functions (Harman et al 2012). Table 2-1 shows a preliminary estimate of the functional lift that may occur as a result of implementing the different stream restoration approaches outlined in Alternative 2-Proposed Action. A variety of parameters can be used to measure stream functions qualitatively and quantitatively, providing the mechanism for measuring the functional lift resulting from restoration and, therefore, project success. For example, a stream that is "functioning at risk" because of the decreased amount or absence of large wood and is restored using the P1-floodplain reconnection approach would achieve the highest level of geomorphological function with regard to large wood. The functional lift would be measured by quantifying the increase in large wood in the stream.



Source: Harmon 2012

FIGURE 2-1: STREAM FUNCTIONS PYRAMID

TABLE 2-1: EVALUATION OF POTENTIAL STREAM FUNCTION ASSOCIATED WITH PROPOSED RESTORATION APPROACHES[1]

		Pre-restoration	Post-restoration		
		Existing	P3 Benches	P2 Excavation	P1 Reconnection
Level and Category	Parameter	Functional Capacity			
1. Hydrology	Runoff				
2. Hydraulics	Floodplain Connectivity				
3. Geomorphology	Large Woody Debris				
	Streambank Stability				
	Riparian Vegetation				
	Bed Form Diversity				
4. Physicochemical	Water Quality				
5. Biology	Macroinvertebrate				
	Fish Communities				

Legend Functional Capacity

< Functioning <

Functioning at Risk

Not Functioning

[1]Table 2-1 is intended only for purposes of describing the types of functions that may increase functional capacity but it is not intended to predict the final functional capacity of the restored streams.

2.2 ALTERNATIVES CONSIDERED IN DETAIL

In October 2012, Duke Energy submitted a Compensatory Mitigation Plan (CMP) (Duke Energy 2012) to the USACE as part of the Section 404 process for Duke Energy's proposed Lee Nuclear Station, in Cherokee County, South Carolina. The CMP provided a plan to mitigate the losses of aquatic function and other impacts expected to result from constructing a drought contingency pond for the Lee Nuclear Station. Duke Energy's CMP involves a combination of mitigation bank credits and permittee-responsible mitigation, including restoration, enhancement, and preservation of wetlands and streams.

During the process of developing the CMP, the USACE and the Forest Service identified an area in Sumter National Forest, Enoree Ranger District that could provide stream and wetland mitigation on a watershed-based, landscape scale. Duke Energy agreed that landscape-scale restoration would best meet stream restoration goals (e.g., stability, floodplain function, enhancing ecological and aquatic communities) while also providing stream credits to offset the impacts of constructing the drought contingency reservoir.

Duke Energy's CMP included four watersheds in Chester County, South Carolina, and approximately 18 miles of streams including: McCluney Branch, Little Turkey Creek, Clarks Creek, and an unnamed tributary to Clarks Creek. These selected streams are functionally impaired as a result of sedimentation, stream incision, and streambank instability and associated degradation of water quality and aquatic habitat. The Forest Service identified stream restoration

as a goal in its Forest Plan specifically to stabilize stream banks, improve stream habitat, and restore and enhance hydrology and aquatic functions.

In the October 2012 CMP, Duke Energy proposed various stream restoration methods involving a significant amount of land disturbance and soil disposal based on the assumption that legacy sediments occurring in the four watersheds are very deep (up to 10 feet). However, some initial soil interpretations and findings suggested otherwise (Jennings 2012). In 2013 and 2014, exploratory trenching studies revealed that the legacy sediments in the four watersheds are variable up to 8 feet or more, but locally relatively shallow (less than 2.5 feet) and that the sediments are not strictly alluvial in composition, as previously thought (Atkins 2014). Further exploration and streambank surveys suggest that the energy from the constrained gully channels eroded into a combination of parent material and bedrock with local controls of Holocene Paleosol bedrock sills. The Forest Service used this information, along with the goals and objectives in the Forest Plan, to develop a proposed restoration approach that would cause fewer impacts, provide greater functional lift, and result in a greater degree of sustainability for the restored streams. This restoration approach is defined in Alternative 2-Proposed Action.

The CMP and Alternative 2-Proposed Action are similar in their landscape approach, location (four watersheds in Chester County), and approximate number of stream miles to be restored. On some segments of the watersheds, Alternative 2-Proposed Action and the CMP are similar in the restoration methods/approach; however, Alternative 2-Proposed Action requires less soil disposal, fewer ground disturbing activities, greater functional lift, and a greater degree of stream sustainability.

The USACE noted that many CMPs evolve based on existing information, stream design technology, and costs. Alternative 2-Proposed Action is an example of using existing information to modify the CMP with the same overall goal of restoring streams and enhancing habitat, but with a smaller footprint and less overall impact to forest resources.

2.2.1 *Alternative 1-No Action*

Alternative 1-No Action provides a baseline against which impacts of the action alternative can be measured and compared. Under this alternative, none of the specific stream restoration activities would occur in the four watersheds, resulting in no functional lift or stream improvements. On-going activities such as recreation, wildlife opening maintenance, timbering, and other forest management activities would continue as listed in the Forest Plan. Stream impacts and channel instability resulting in erosion and sedimentation would continue.

There are no connected actions associated with Alternative 1-No Action.

2.2.2 *Alternative 2-Proposed Action*

Alternative 2-Proposed Action provides for restoration of the four watersheds using a variety of methods to re-establish natural channel form, floodplain function, habitat conditions, and provide functional lift. Restoration would involve moving earth and filling and shaping the channel and floodplain. Soil borrow and disposal areas needed during restoration work would be located within the four small Project watersheds and as near to the stream work to the extent possible.

To accomplish the restoration work, the following restoration design approaches would be used: P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches. Definitions for the design approaches are provided in Table 2-2 and a summary of the stream restoration approaches are included in Table 2-3.

TABLE 2-2: SUMMARY OF THE TERMS AND DEFINITIONS OF THE PROPOSED RESTORATION APPROACHES

Restoration Approach (based on Rosgen, 1997)	**Terms and Definitions**
P1-Floodplain Reconnection	• Raise the streambed and use the existing valley elevation as the floodplain. • Create a meandering stable channel on existing forest bottom with alternating riffle and pool bed forms. • Small headwater streams may have a small step-pool channel or swale. • Fill/plug sections of old stream channel and create oxbow ponds and wetlands; may include the use of groundwater dams.
P2-Floodplain Excavation	• Excavate, at the stream's existing bankfull elevation, a new floodplain that is wide enough to support a meandering channel. The stream bed elevation remains nearly the same. • Create or allow for the natural development of a meandering channel with alternating riffle and pool bed forms.
P3-Floodplain Benches	• Constraints in the stream corridor will not support a meandering channel. • Excavate relatively narrow, floodplain benches at the stream's existing bankfull elevation. • Create a relatively straight channel that dissipates energy through a step-pool bed form rather than a meandering stream.

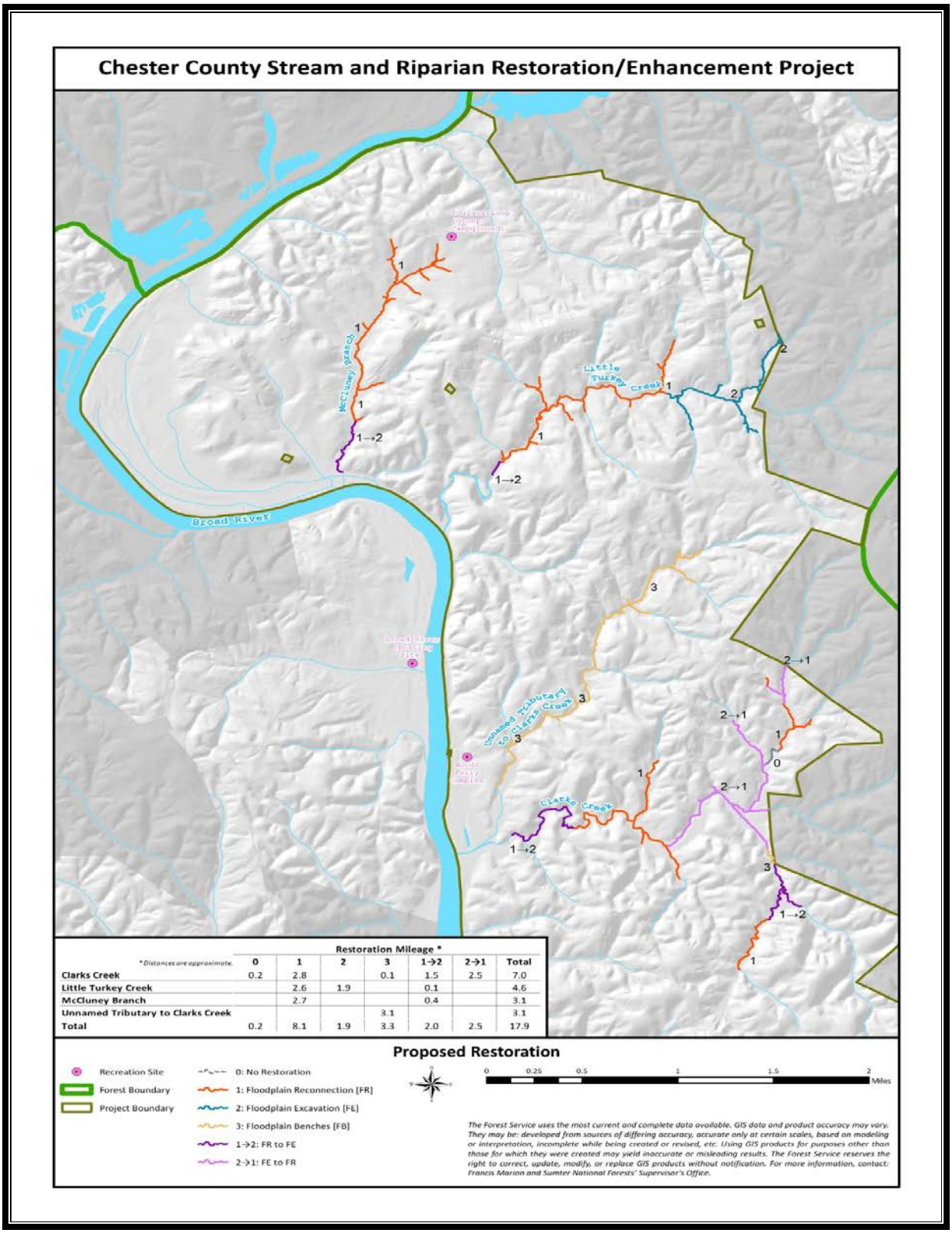
Source: Rosgen. D.L. 1997. A Geomorphological Approach to Restoration of Incised Rivers. In: Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision, S.S.Y Wang, E.J. Langendoen, & F.D. Shields (Editors). University of Mississippi. Oxford.

TABLE 2-3: SUMMARY OF THE PROPOSED RESTORATION APPROACHES, APPROXIMATE STREAM LENGTHS AND SOIL BORROW AND SOIL DISPOSAL QUANTITIES

			Stream Restoration Design Approach **All lengths are approximate**					**Connected Action-Soils** **All volumes are approximate**	
Project Watersheds		No Restoration	P1-FR	P2-FE	P3-FB	Transition Zone FR to FE	Transition Zone from FE to FR	Soil Borrow in CY	Soil Disposal in CY
	McCluney Branch			N/A	N/A	2,240 LF (0.4 miles)	N/A	44,100 CY	5,200 CY
	Little Turkey Creek		13,910 LF (2.6 miles)	9,830 LF (1.9 miles)	N/A	590 (0.1 miles)	N/A	93,100CY	77,100 CY
	Clarks Creek	880 LF (0.2 miles)	14,640 LF (2.8 miles)	N/A	730 LF (0.1 miles)	7680 LF (1.5 miles)	13,180 LF (2.5miles)	144,900 CY	284,600 CY
	Unnamed Tributary to Clarks Creek		N/A	NA	16,630 LF (3.3 miles)	N/A	N/A	0 CY	27,500 CY
	Total Length for each Design Approach	0.2	8.1 miles	1.9 miles	3.3 miles	2.0 miles	2.5 miles		

Key CY Cubic yards
FB Floodplain Benches
FE Floodplain Excavation
LF Linear Feet
FR Floodplain Reconnection

Selection of a restoration approach is made for each stream segment based on individual stream and floodplain conditions, and a combination of approaches is typically employed within an individual watershed to meet site conditions. An understanding of the approach can be used to generally describe the Project footprint, the amount of excavation and fill material needed to complete the work, and the ecological outcome of the proposed Project. Implementation would ultimately require more detailed designs that identify specific construction details (e.g., channel patterns, longitudinal profiles, tie-in to existing grade control features [e.g., may be slightly upstream of mapped restoration reach], cross-sections, in-stream channel structures for aquatic species habitat [e.g., large wood, rock substrate], substrate modifications, planting native vegetation, and restoration of work areas). The proposed stream restoration approaches for the various stream reaches are identified in Figure 2-2. The following narrative describes each watershed and the proposed stream restoration approach.



Source: USFS 2014
Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

FIGURE 2-2: PROPOSED STREAM RESTORATION APPROACHES

McCluney Branch

Proposed activities for restoration within McCluney Branch include P1-floodplain reconnection and P2-floodplain excavation. Depictions of P1-floodplain reconnection and P2-floodplain excavation are provided in Figure 2-3 through Figure 2-6. A hybrid restoration approach would be used in smaller drainage areas to create a wetland/intermittent stream complex with few or no defined stream channels, similar to the streams historically present in these areas. Restoration would involve some earthmoving and shaping of the floodplain using soil borrowed from areas both within and potentially outside of the watershed. In the lower portion of McCluney Branch, P2-floodplain excavation would be used to move the stream bed to the elevation of the stream near the Broad River.

Little Turkey Creek

The P2-floodplain excavation approach would be used in the upstream part of the watershed. The P1-floodplain reconnection approach would be used in the middle part of the watershed. P2-floodplain excavation would be used to reconnect the restored channel with the existing stream channel in the lower portion of the watershed. Restoration would involve some earthmoving and shaping of the floodplain using soil borrowed from areas both within and potentially outside of the watershed. Structural diversity (e.g., boulders and cobble rock) may be added to a portion of the newly created stream channel.

Clarks Creek

All three approaches (i.e., P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches) would be used to restore Clarks Creek. An example of floodplain benches is provided in Figure 2-7 and Figure 2-8. Restoration of the upstream portions of Clarks North Fork tributary would begin with P2-floodplain excavation, transitioning quickly to P1-floodplain reconnection below the first tributary stream; this tributary stream would have a short section of P1-floodplain reconnection in its headwaters. Downstream of this area, the P1-floodplain reconnection approach would be used before reaching a short segment where no restoration is proposed. The approach for the middle sections of Clark Creek would be to progress from P2-floodplain excavation down into P1-floodplain reconnection along the mainstem of Clarks Creek, where P2-floodplain excavation would be used to tie the restored stream into the existing stream bed. Within the Clarks South Fork tributary, P1-floodplain reconnection would proceed to P2-floodplain excavation, and then a short segment adjacent to the Project Area boundary would be restored using the P3-floodplain bench approach. The downstream area would transition from P2-floodplain excavation back to P1-floodplain reconnection, as it joins the mainstem at the confluence with Clarks North Fork. Restoration would involve extensive earthmoving and shaping of the floodplain, including both the use of borrowed soil and disposal of excess soil to areas outside of the floodplain but within upland areas of the watershed.

Unnamed Tributary to Clarks Creek

The unnamed tributary to Clarks Creek would be restored using the P3-floodplain benches approach and P2-floodplain excavation in particular sections. Restoration activities proposed on this stream would be targeted in key problem areas to augment natural changes the stream channel undergoes as it moves toward greater stability. Restoration would involve moderate to extensive earthmoving and shaping of the floodplain in key areas, including both the use of borrowed soil and disposal of excess soil to areas outside of the floodplain. Soil borrow and disposal areas would be located within the watershed to the most reasonable extent possible.

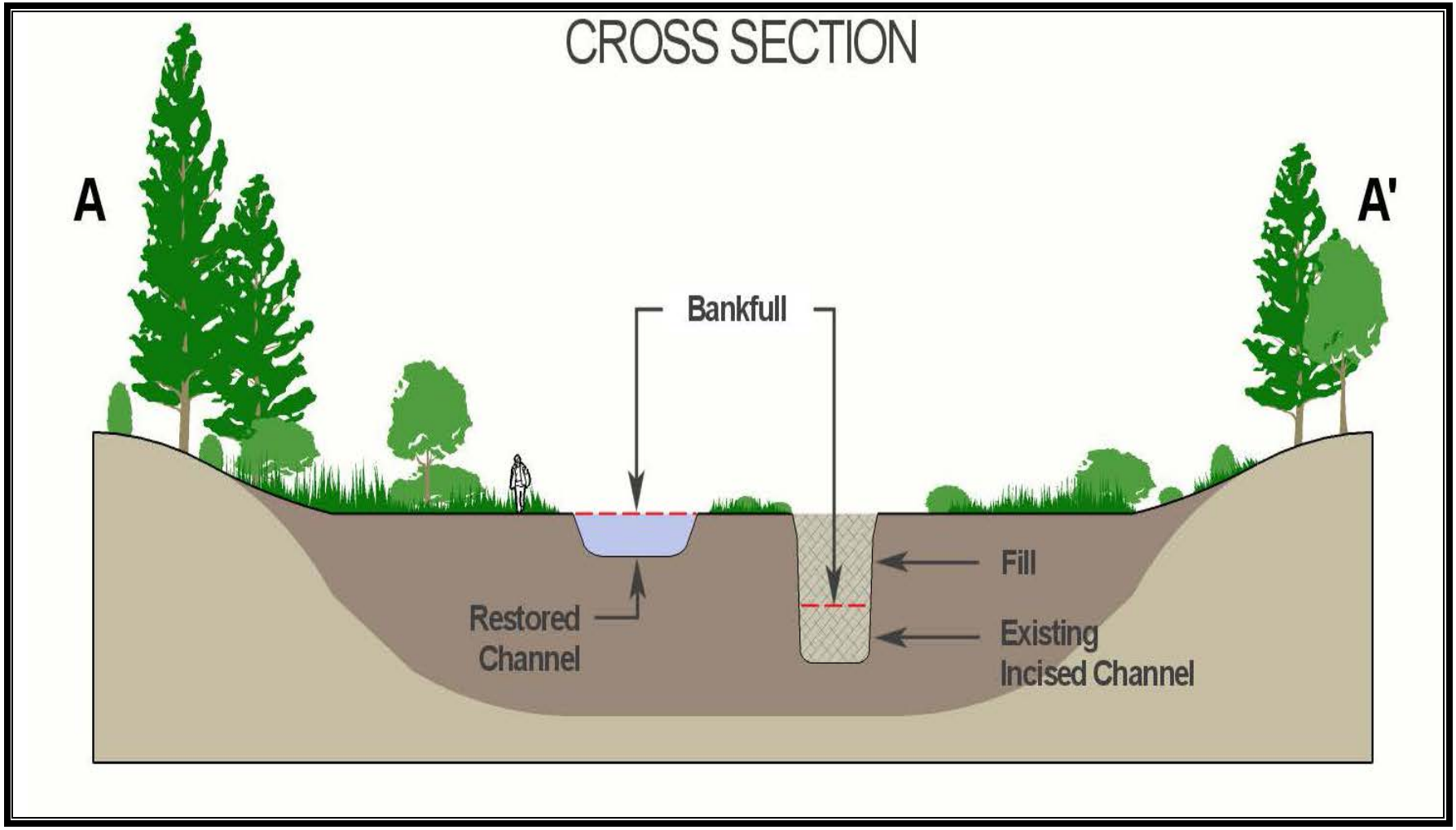


FIGURE 2-3: P1-FLOODPLAIN RECONNECTION APPROACH-CROSS SECTION VIEW

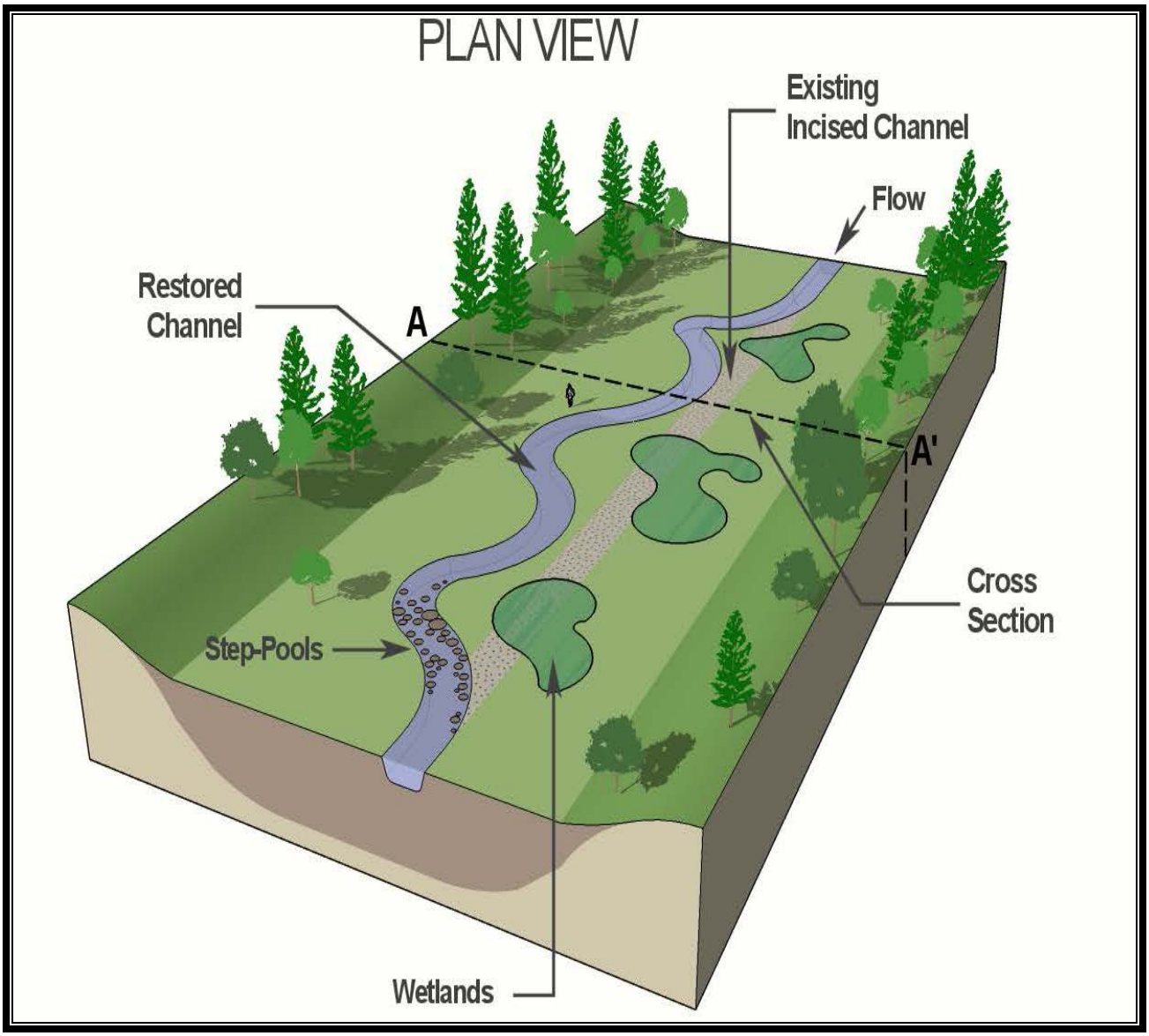


FIGURE 2-4: P1-FLOODPLAIN RECONNECTION APPROACH-PLAN VIEW

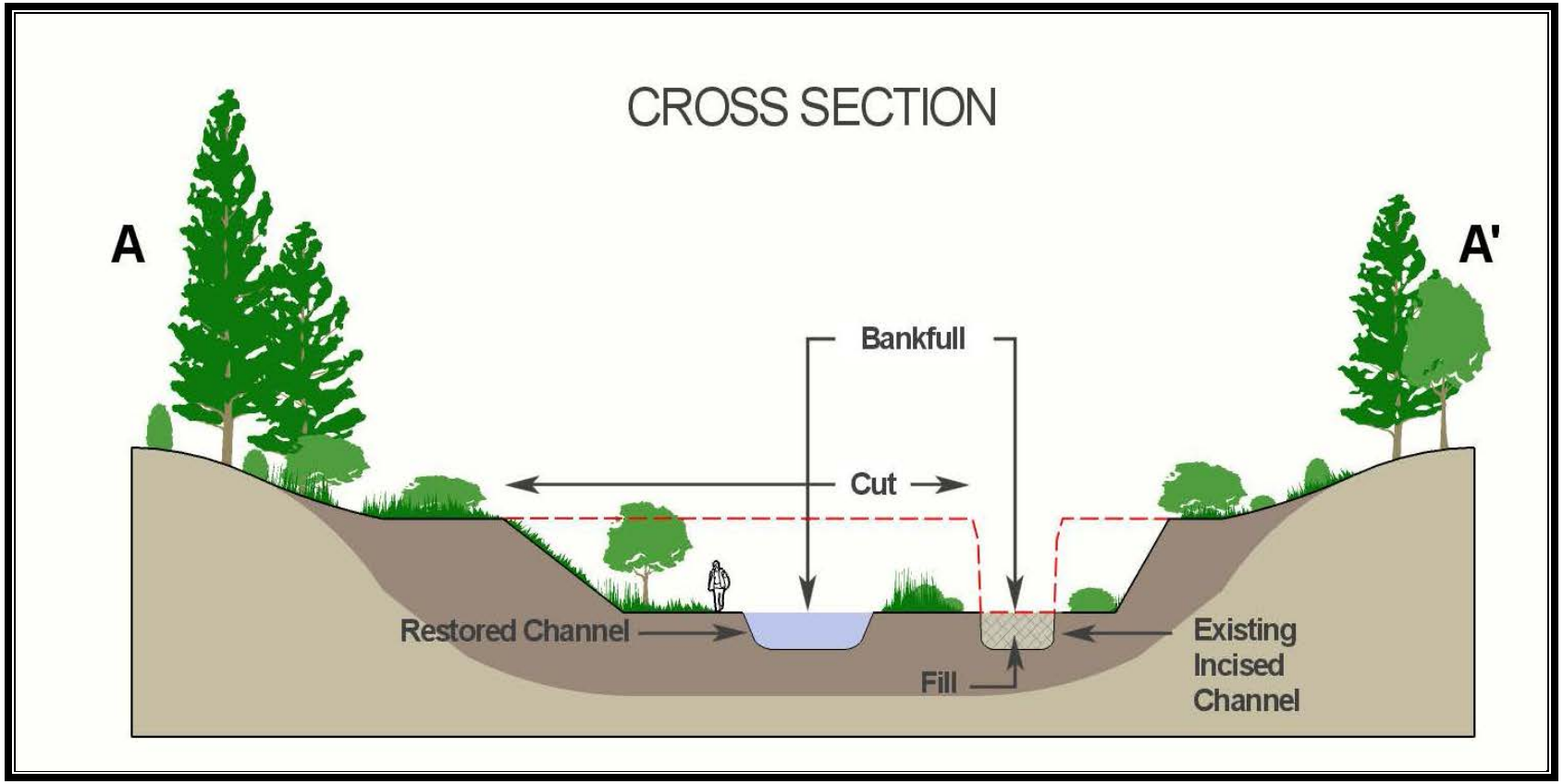


FIGURE 2-5: P2-FLOODPLAIN EXCAVATION APPROACH-CROSS SECTION VIEW

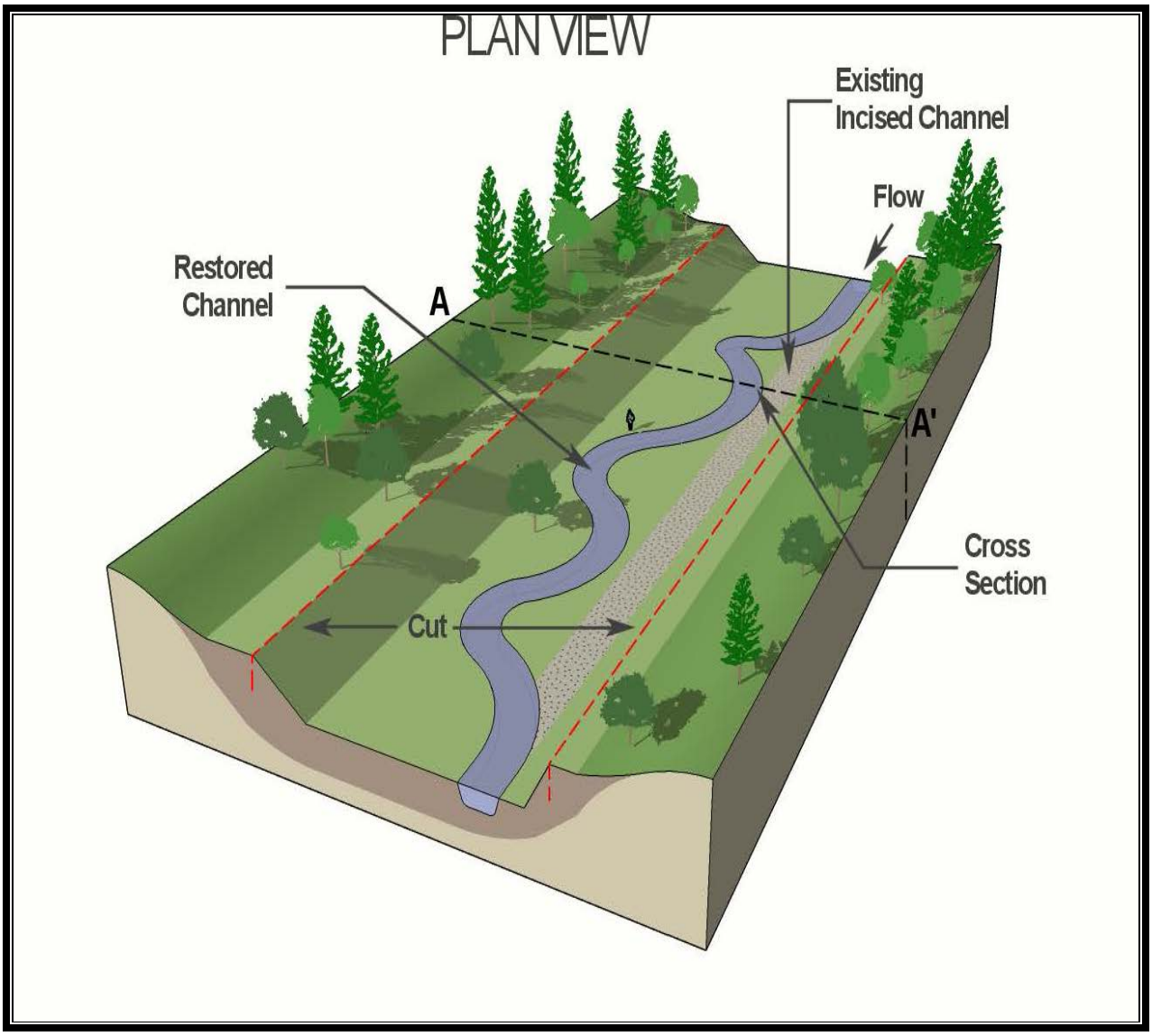


FIGURE 2-6: P2-FLOODPLAIN EXCAVATION APPROACH-PLAN VIEW

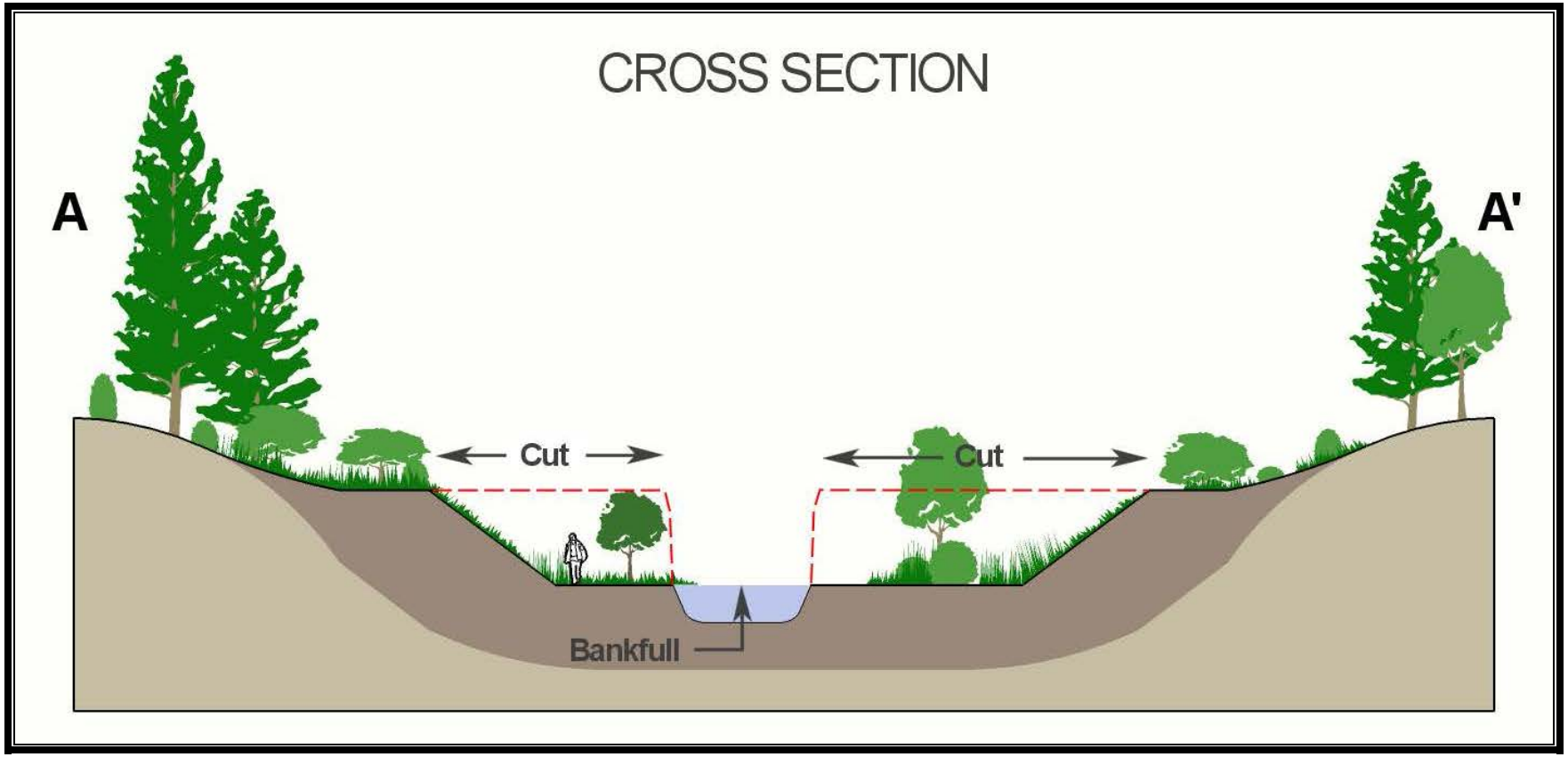


FIGURE 2-7: P3-FLOODPLAIN BENCH APPROACH-CROSS SECTION VIEW

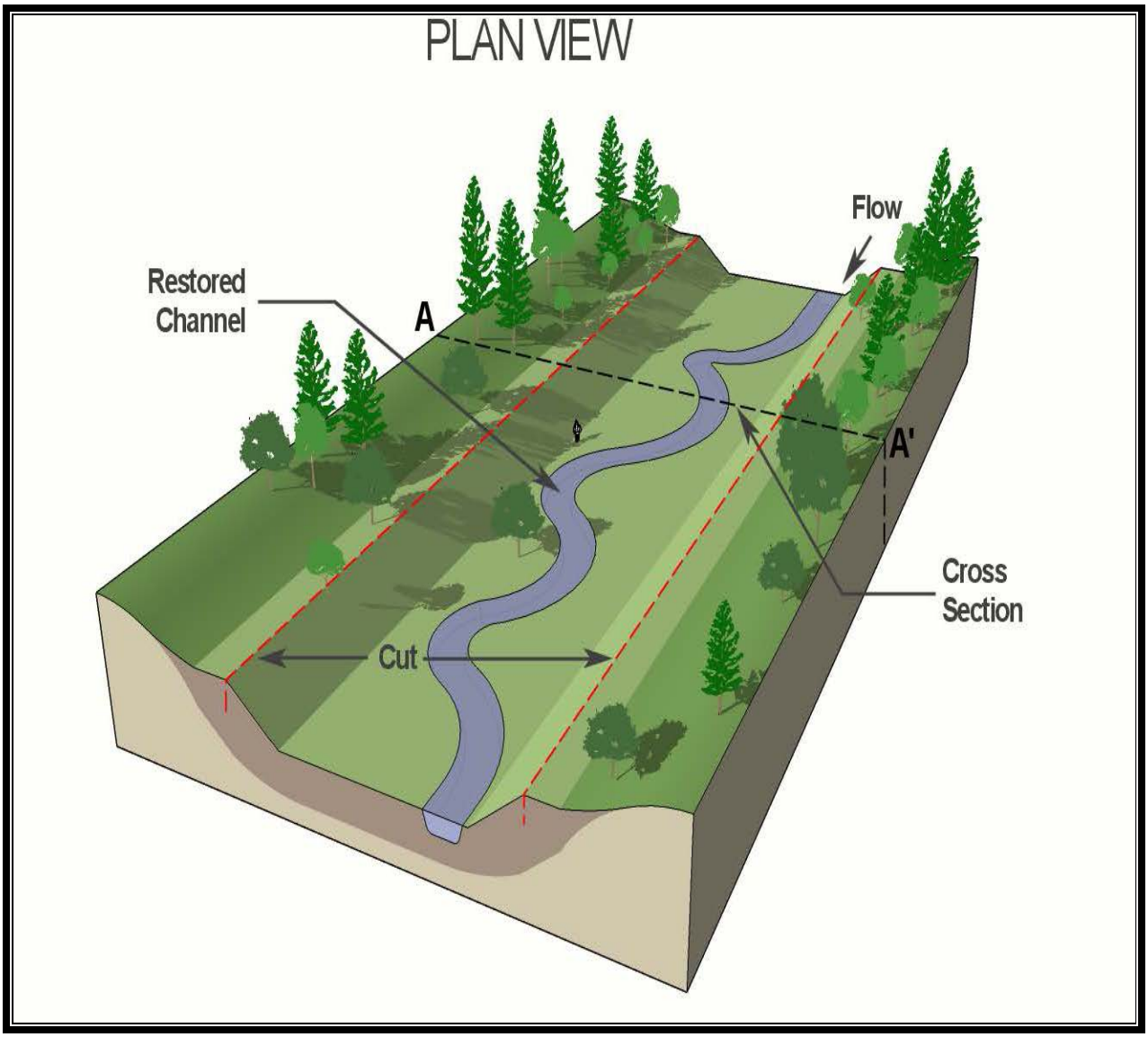


FIGURE 2-8: P3-FLOODPLAIN BENCH APPROACH-PLAN VIEW

2.2.3 *Forest Plan Amendment*

Alternative 2-Proposed Action includes a non-significant Forest Plan amendment. The amendment would change current Forest Plan management direction to allow for implementation (construction, reconstruction and maintenance) of the Project in and along Project streams only.

Proposed Forest Plan changes would:

1. Allow heavy equipment within Project stream channels during implementation and maintenance activities.
2. Allow removal of trees and other vegetation on Project stream banks during implementation and maintenance activities.
3. Allow removal of hardwood inclusions (1/2 acre in size or larger) in pine stands dominated by hard and soft mast species where needed during implementation activities.
4. Allow removal of trees in areas with old growth characteristics where necessary during implementation of the stream restoration Project.
5. Allow removal of healthy shortleaf pine in areas where necessary during implementation of the stream restoration Project.
6. Allow stream restoration Project work to take place on plastic soils with approval of the Forest Service soil scientist on a case-by-case basis.
7. In the short term, change the Scenic Integrity Objective (SIO) for stream restoration work to moderate in management prescriptions 6.C, 7.D, 7.E.1, 7.E.2, 9.A.3, 9F, and 11 in the Project Area to allow the restoration work to be completed.
8. Allow temporary removal of large woody material during restoration and maintenance work.
9. Allow minimal impacts to rare communities during Project stream restoration and maintenance work.

2.2.4 *Connected Actions*

The following activities would be conducted in connection with Alternative 2-Proposed Action.

2.2.4.1 Road Reconstruction and Maintenance

Approximately 23 miles of existing Forest Service roads would require maintenance, reconstruction, or both in order to allow access by the heavy equipment needed for restoration. Reconstruction and maintenance would also be required on up to 5.6 miles of state roads that may be needed during Project activities. Reconstruction work would include graveling road surfaces; replacing culverts (including designing culverts for passage of aquatic organisms); repaving/chip-sealing, cleaning ditches; removing brush and trees along rights-of-way; installing, repairing, or replacing gates; and correcting road safety hazards. Some bridges may need to be replaced to accommodate the new elevation of restored streams. Road maintenance would consist of replacing gravel in selected spots, road grading, repaving/chip-sealing, cleaning culverts, and light brushing and mowing.

2.2.4.2 Temporary Roads

Approximately 13 miles of temporary roads would be constructed during Project implementation. Upon completion of restoration activities, temporary roads would be closed and obliterated. Adequate measures would be implemented to control erosion and stormwater. Road surfaces would be replanted with native and desirable non-native vegetation.

2.2.4.3 Soil Borrow and Soil Disposal Areas

Implementing Alternative 2-Proposed Action would generate the need for soil to fill in and shape the new channels and adjacent areas. Likewise, deposited sediment would have to be removed from some locations, generating soil that would need to be deposited elsewhere. Approximately 663 acres of National Forest system lands within the Project Area have been identified as potential soil deposit or borrow areas. Not all of these areas would be needed during Project activities. The intent in selecting these areas is to ensure the least impact on natural resources while providing flexibility in design and efficient transport to stream restoration areas (as needed). Soil testing may be needed to identify areas that have the appropriate characteristics to be used as fill material in streams. Sites would be cleared of trees and stumps. Areas would be replanted with trees. Planted trees would include those appropriate for the site and include, but not be limited to, shortleaf pine, loblolly pine and hardwoods. Excess soil would be spread over areas to a depth of 12 to 18 inches. Soil borrow areas would likely would be filled in and returned to their original contour. Old road beds in these areas may be filled in and returned to a natural condition. All disturbed areas would be stabilized following standards in the Forest Plan, which could include seeding with native and desired non-native plants to control erosion, dips, leadouts, reverse grades or water-barring to control concentrated flow to limit erosion and sedimentation, and if appropriate, other practices such as installing silt fencing and creating sediment ponds. The Forest Service estimated that between 70-100 acres would be used for soil borrow and soil disposal.

2.2.4.4 Merchantable Timber

Implementing Alternative 2-Proposed Action would require removing trees within the stream restoration areas and from the soil borrow and disposal areas. Merchantable timber probably would be sold (estimates of volumes, costs, and value of timber are described in Section 3.14). Some of the woody material would be used to stabilize and restore streams. Trees would be cut down, skidded to landings, and transported off site or used in the restoration work. All landings and skid trails would be closed, water-barred, and seeded after construction. Any staging/mobilization and equipment storage areas needed would be located in previously disturbed areas, as much as possible.

2.3 ALTERNATIVES CONSIDERED BUT NOT DEVELOPED

2.3.1 *Structural Stream Restoration*

The Forest Service considered using structural controls, such as concrete, rip-rap, and gabions to stabilize streams. These methods do not improve habitat in streams and surrounding riparian environments (e.g., floodplain), are not aesthetically pleasing, provide less functional lift than other methods, and do not address the underlying and continuing channel incision. These methods do not meet the Forest Service's objectives for scenic

integrity or Goal 1 of the Forest Service's stream function objectives; therefore, they were not considered for analysis in the Final EIS.

2.3.2 *Bioengineering*

The Forest Service considered implementing bioengineering to restore the four watersheds. This alternative would include creating brush layers, brush mattresses, and geolifts and planting along the streambanks. This option includes minimal grading but does not address the cause of stream instability (i.e., the incising in the streams) or provide bankfull P3-floodplain benches. Bioengineering alone would not provide functional lift. Reducing channel incision and providing functional lift are Forest Service goals defined in the Forest Plan; therefore, this method was not considered for analysis in the Final EIS.

2.3.3 *Hydrologic Easements*

The Forest Service considered using the P1-floodplain reconnection design approach in additional areas where the restoration design may provide additional functional lift; however, in 6 areas the proposed stream segments abut private lands. The P1-floodplain reconnection design would raise the stream to the floodplain, creating additional wetted areas that could exceed the forest boundary, and intrude upon and alter private lands. All 6 areas would require a hydrologic easement to maximize the functional lift value. The Forest Service determined that the incremental value of any one of the 6 additional P1-floodplain reconnection design segments on the forest was limited and would not produce substantially greater functional lift. Furthermore, there is no guarantee that any of the private landowners would agree to a hydrologic easement on their property; therefore, the Forest Service determined that other restoration design approaches would provide an adequate level of functional lift and avoid hydrologic trespass, making the pursuit of easements unnecessary for this Project to proceed to implementation. Therefore, this alternative was considered but not developed.

2.4 MITIGATION MEASURES COMMON TO ALL ACTION ALTERNATIVES

Mitigation measures for the action alternative are incorporated from the following documents: *Revised Land and Resource Management Plan, Sumter National Forest* (2004); *South Carolina's Best Management Practices for Forestry* (South Carolina Forestry Commission 2003) and *National Best Management Practices for Water Quality Management on National Forest System Lands* (2012), collectively referred to in this document as Best Management Practices (BMPs), the *Soil and Water Conservation Practices Guide, Southern Region* (USDA 2002), and *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects* (U.S. Department of Transportation 2003). The following site-specific mitigation measures are included to avoid or minimize adverse environmental effects from the selected alternative.

In the event this Project is implemented as part of a compensatory mitigation project, USACE regulations at 33 CFR Chapter II Part 332 and 40 CFR Chapter I Part 230-Section 404(b)(1) would also apply to the permittee for a USACE 404 permit.

2.4.1 *Soils and Water*

1. Develop and implement a Stormwater Pollution Prevention Plan (SWPPP) that follows SCDHEC Erosion and Sediment Control Standards and BMPs.
2. To minimize potential for soil runoff into streams:
   a. Erosion control methods would be used during all Project activity as needed to deter soil runoff into perennial, intermittent or channeled ephemeral streams.
   b. Erosion control methods would be maintained until plant growth is established and stable enough to control runoff and erosion.
   c. To minimize soil movement, temporary roads would be rehabilitated and closed following Project implementation and would be covered with woody debris, mulch material, limed, seeded with native and desired non-native annual and perennial grasses and fertilized. Some temporary roads would remain closed but available for administrative use during monitoring and maintenance.
3. For the protection of intact A and E horizons[2], soil borrow and fill areas would not be located within areas determined to have existing, intact A and E horizons, as determined by the Forest Soil Scientist.
4. Soil borrow pits will be filled with soil disposal material.
5. Soil fill in Project Area streams, including the old stream channel where specified, would be compacted in layers sufficient to avoid excessive settling.
6. Native plants/trees used for streambanks and floodplains would include those which have deep dense rooting systems, such as river cane, rushes and sedges.
7. Streams would be diverted, pumped around activity areas when needed to reduce working in the flowing water.
8. Gravel, cobbles, and boulders would be removed as desired from the channel before filling occurs and stockpiled for later use in rebuilding the channel.
9. Trees, woody debris, root wads, brush and other materials would be removed from the old stream channels to be filled to avoid settling of materials.
10. Some of these woody materials will be stockpiled for instream uses to stabilize banks or augment fishery habitat or when building groundwater dams (logs and clay placed across the valley to help hydrate the floodplain and provide grade control).
11. Repairs for in-channel work may require the use of low ground pressure equipment or mats to access problem areas.

2.4.2 *Aquatics*

1. Aquatic organism passage culverts would be installed on perennial and intermittent Project streams during temporary road construction and road reconstruction as determined by the Forest Aquatic Biologist.
2. Trees removed from the riparian area during restoration would have priority use for instream and riparian habitat.

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[2] E horizon: Mineral horizons in which the main feature is loss of silicate clay, iron, or aluminum, or some combination of these, leaving a concentration of sand and silt particles. These horizons exhibit obliteration of all or much of the original rock structure.
A Horizon: Mineral horizons which have formed at the surface or below an O horizon; they exhibit obliteration of all or much of the original rock structure and show one or both of the following: (1) an accumulation of humified organic matter intimately mixed with the mineral fraction and not dominated by properties characteristic of E or B horizons, or (2) properties resulting from cultivation, pasturing, or similar kinds of disturbance.

3. Aquatic species reintroduction will occur in at least one Project stream immediately following restoration and in the remaining streams if 2 years of monitoring indicates low species diversity and density.

2.4.3 *Rare Plant Communities, Future Old Growth, Native Ecosystems*

1. Develop and implement a revegetation plan to include use of a diversity of native and desirable non-native herbaceous and woody vegetation for erosion control and for restoring native ecosystems. The Forest Botanist and Forest Soil Scientist or other appropriate Forest Service personnel would be consulted on the planting mix. Treatment of vegetation will occur as needed to achieve desired conditions.
2. Minimize the removal of existing native vegetation where possible during construction, except where needed for reuse in restoration plantings.
3. Replant with native ecotypes and native and desirable non-native species. Relocate patches of existing native vegetation occurring within impacted areas when needed and appropriate to the restored environment.
4. To minimize impacts to rare plant communities and future old growth remnants, tree planting, log deck placement, and temporary road construction would avoid, to the extent possible, rare community inclusions as identified in the basic mesic forest assessment (January 2014) and the potential old growth forest assessment (January 2014).

2.4.4 *Non-native Invasive Species Plants*

1. Control, mitigate and prevent the introduction and spread of NNIS plants within the Project Area:
    a. Develop and implement standard contract provisions to include the cleaning of equipment when moving between areas to avoid introduction or spread of NNIS.
    b. Treat the entire extent of NNIS populations occurring within the Project Area prior to and following stream restoration, as needed;
    c. All materials (plant materials, mulch, gravel) brought on site would be from weed-free sources when such sources are available and economically comparable to other sources.
2. To minimize impacts to rare plant communities and future old growth remnants, tree planting, log deck placement, and temporary road construction would avoid, rare community inclusions as identified in basic mesic forest assessment (January 2014) and the potential old growth forest assessment (January 2014) to the extent possible.

2.4.5 *Proposed, Endangered, Threatened and Sensitive Species*

Per FW-28, the following measures shall be followed:

1. Protection zones are delineated and maintained around all bald eagle nests and communal roost sites, until they are determined to be no longer suitable through coordination with the USFWS. The protection zone extends a minimum of 1,500 feet from the nest or roost. Activities that modify the forest canopy within this zone are prohibited.

    All management activities not associated with bald eagle management and monitoring are prohibited within this zone during periods of use (nesting season is October 1 to

June 15; roost use periods are determined through site-specific monitoring). Where controlled by the Forest Service, public access routes into or through this zone are closed during the seasons of use, unless they are major arterial roads.

2. Coordinate all ground-disturbing activities (including road reconstruction and maintenance, temporary road construction, timber harvesting operations, and soil borrow/deposition activities) with Forest Service biological staff within and near the following Georgia aster sites: Wade Road (FS Road 301A), Wild Turkey Road (FS Road 301C), Bucks Grave Road (FS Road 305), Hines Road (FS Road 305E), and other sites that may be identified in the Project Area in the future.
3. Avoid damage to Georgia aster during road reconstruction and maintenance activities.
4. Temporary roads are not permitted within Georgia aster sites.
5. Timber harvesting is permitted within Georgia aster sites, but the following measures shall be followed:
    a. Avoid the use of logging equipment and other heavy machinery within Georgia aster sites (hand tools may be used to fell trees within Georgia aster sites).
    b. Attempt to fell trees away from Georgia aster sites.
    c. Skid trails and log decks are prohibited within Georgia aster sites. Avoid skidding trees through Georgia aster sites; however, trees may be skidded out of Georgia aster sites as long as damage does not occur to Georgia aster.
6. Soil borrowing and deposition is prohibited within Georgia aster sites. This activity is permitted adjacent to Georgia aster sites as long as there are no direct or indirect effects to Georgia aster.

2.4.6 *Scenic and Recreation*

1. To improve SIOs, natural materials likely to occur in the Project Area (e.g., rocks, vegetation) would be incorporated within the foreground viewshed of roads, trails or other recreation facilities.
2. Disturbed areas adjacent to Forest Service Road 574 would be re-vegetated with native vegetation including hardwoods and flowering trees within the immediate foreground viewshed (approximately 300 feet).
3. Place root wads out of sight of County Road 574 and at trailheads.
4. Vegetation clearing outside of the channel restoration area would be blended so they remain subordinate to the existing landscape character in size, form, line, color and texture, as practicable.
5. Construction activity and soil borrow and disposal areas would avoid the scenic vista along the Broad River.
6. Temporary roads, main skid trails and landings would be located outside the immediate foreground viewshed of roads, trails or other recreation facilities, where practicable. If these features must be located in the immediate foreground viewshed of roads, trails or other recreation facilities, bare mineral soil would be re-vegetated or covered with woody material as soon as possible following restoration.
7. Soil borrow and fill areas would be positioned outside of the immediate viewshed of trail corridors, including the proposed River Trail (Compartment 7 Stand 5), or at least 50 feet from the trail corridor, where possible.

8. Borrow and fill areas visible to the roads would be broken up spatially (at least 1,000 feet apart), where possible, to avoid large contiguous visible areas of vegetation disturbance along open Forest Service system roads and County Road 574.
9. Trail corridors would be cleared of downed trees resulting from stream restoration activities within the Project Area.
10. Coordinate with Enoree Ranger District recreation staff and post advance notices when trails are to be closed during restoration activities.
11. Trails adjacent to restored stream sections may be temporarily closed to trail traffic until the area is stabilized.
12. Construction would be staggered in space and time between watersheds in the Project Area to reduce recreation impacts, when possible. Restoration work in Little Turkey Creek and in unnamed tributary to Clarks Creek would not be implemented at the same time in order to minimize impacts to recreation users.
13. Shooting safety zones will be established and signed where restoration work is occurring during large game rifle seasons, and other hunting seasons if necessary.
14. Either the proposed Woods Ferry Horse Trailhead (to be located on Bucks Grave Road) or the existing trailhead off of Forest Service Road 301C would remain accessible until all stream restoration on Little Turkey Creek is complete.
15. Existing trail corridor, character trees, and hardwood trees would be preserved where possible.
16. Trail stream crossing approaches in the Project Area would be hardened using Forest Service approved techniques. Trails may be relocated to a suitable area, if necessary. Water access points would be designated and hardened to protect resources and provide water access for horses.
17. Due to increased sunlight in the area following restoration, affected trail corridors would undergo heavy brushing to reduce vegetation and prevent trails from becoming impassable.
18. Following restoration, block temporary roads and skid trails crossing trail corridors with down trees and brush so they are not visible to recreation users.
19. Trails would not be used as a skid trail or haul road when possible. Project equipment and machinery would cross trails at designated areas.
20. Stream restoration design would minimize impacts to the current location of the trail in Compartment 9, Stands 3 and 5 within the unnamed tributary to Clarks Creek corridor.
21. Project activity would not be allowed in the Woods Ferry Recreation area including use of Forest Service system roads 309, 309A and 309B.

2.4.7 *Heritage*

The Project would be implemented in accordance with a Programmatic Agreement (PA) with the State Historic Preservation Office (SHPO) and The Advisory Council on Historic Preservation (ACHP) pursuant to 36 CFR part 800.14(b) under the implementing regulations of Section 106 of the National Historic Preservation Act (NHPA). The PA would comply with Section 106 through the use of a phased approach in the identification of historic properties and the assessment of adverse effects. The PA is the best approach due to the scale of the proposed undertaking and the need for various engineering designs that would be developed and implemented over the course of several years.

2.4.8 *Roads and Bridges*

1. Develop a transportation operation maintenance plan to be submitted to the Forest Service for approval before commencement of any site-disturbing work. The plan would include periodic inspection by Forest Service and South Carolina Department of Transportation (SCDOT) during Project activities for compliance with approved plan. This plan would include, but not be limited to, information on reconstruction and maintenance, seasonal restrictions, design specifications for temporary roads and bridges, and an evaluation of culvert design that would accommodate aquatic organism passage, analysis of system bridges and reconstruction needs, a SWPPP, emergency spill plans, and public notification. In addition, all Forest Service system roads that are classified as open to use by the public for standard passenger cars would be subject to the Federal Highway Safety Act. This includes roads with access restricted on a seasonal basis and roads closed during extreme weather conditions or for emergencies, but which are otherwise open for general public use.
2. Temporary roads would generally have an aggregate surface to reduce rutting and erosion on roads. Temporary roads within the floodplain or riparian zone would use debris, chunk wood or mats in the place of aggregate surfacing.
3. Temporary roads would use portable spanning structures for all perennial stream crossings. Intermittent and channeled ephemeral stream crossings for temporary roads or skid trails would utilize methods that would maintain stream bank stability and minimize sediment input. Stream channels that were crossed would be returned to a previous natural condition (bank and flow width), to the extent possible.
4. Construction activities would be suspended during wet or saturated soil conditions as determined by the Forest soil scientist, engineer or other Forest Service representative.
5. Traffic control and signing would be used to control Project and public traffic on open system roads.
6. Frequent maintenance (i.e. extra gravel and grading) and moisture control would be used as necessary to reduce dust and keep surface materials stable.
7. Road closure devices meeting Forest Service standards would be used on temporary roads.
8. Temporary bridges and culverts would be installed to avoid erosion and then removed following Project completion. Stream channels that were crossed would be returned to a previous natural condition (bank and flow width), to the extent possible.
9. Erosion control methods would be used during temporary road construction/reconstruction and for skid trails as needed to deter soil runoff into perennial, intermittent or channeled ephemeral streams.
10. Temporary road obliteration methods would include the following in accordance with Forest Service practices:
    a. Restore to approximate original ground contours. Keep excavated material within the original construction limits. Finish slopes to provide gradual transitions in slope adjustments without noticeable breaks.
    b. Close roads by filling ditches and outsloping the roadbed to drain. Restore the natural drainage patterns and eliminate all ruts and low spots that could hold water.

2.4.9 *Vegetation*

Trees would be planted in soil borrow, soil disposal and other areas as directed by the Forest Service. All areas would be planted to full stocking levels with tree species suitable to the site. Pine trees would be planted on a 7 foot by 10 foot spacing. Hardwoods would be planted on suitable sites to increase species diversity, structure and function.

2.5 MONITORING OF PROJECT ACTIVITIES

Monitoring activities are defined within three possible categories: 1) Forest Service monitoring during Project implementation and 2) Forest Service success monitoring after Project implementation, and 3) If the Project should be completed as part of a compensatory mitigation plan, required post-restoration monitoring as required by the USACE.

2.5.1 *Forest Service Monitoring*

Implementation Monitoring

The Forest Service would designate one or more Contracting Officer Representatives (CORs) to monitor Project implementation. CORs would visit the Project Area routinely to insure BMPs and Project mitigations are being effectively implemented, and that ancillary impacts to natural resources are not occurring.

Success Monitoring

The Monitoring Plan contained in the *Revised Land and Resource Management Plan Sumter National Forest* (Forest Plan Appendix E) would be applied to this Project. This plan includes implementation and effectiveness monitoring elements that is multi-disciplinary in nature. Project monitoring activities specific to this Final EIS are described below:

1. Water quality in restored streams-Forest Plan monitoring question #15 and 16
2. Stream bank and channel erosion in restored streams-Forest Plan monitoring question #15 and 16
3. Vegetation recovery in restored streams and soil borrow and soil disposal areas-Forest Plan monitoring question #1
4. Impacts to basic mesic communities-Forest Plan monitoring question #1
5. NNIS infestations-Forest Plan monitoring question #1 and 6
6. Off trail recreation use- Forest Plan monitoring question #10
7. Aquatic species recovery in restored streams-Forest Plan monitoring question #10

Monitoring of each restoration stream would include habitat and aquatic organism surveys following protocol of the pre-project implementation inventories (Atkins 2014). Fish, macroinvertebrates, mollusk and crayfish species would be included for monitoring. Monitoring should begin no later than two years as each stream is restored and continue on a yearly basis until populations are considered stable.

2.5.2 *Permittee-Required Post-Construction Monitoring*

If the Project were completed as part of a permittee-responsible compensatory mitigation project, the permittee would be required, through their compensatory mitigation plan (issued by the USACE), to develop ecological performance standards and complete monitoring and maintenance of the restored streams for a period of not less than 5-years, or until such time as the USACE deemed the Project successful, as defined in 33 CFR Chapter II, parts 332.5 and

332.6. In such a case, this monitoring would be in addition to the Forest Service monitoring described above.

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CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 OVERVIEW

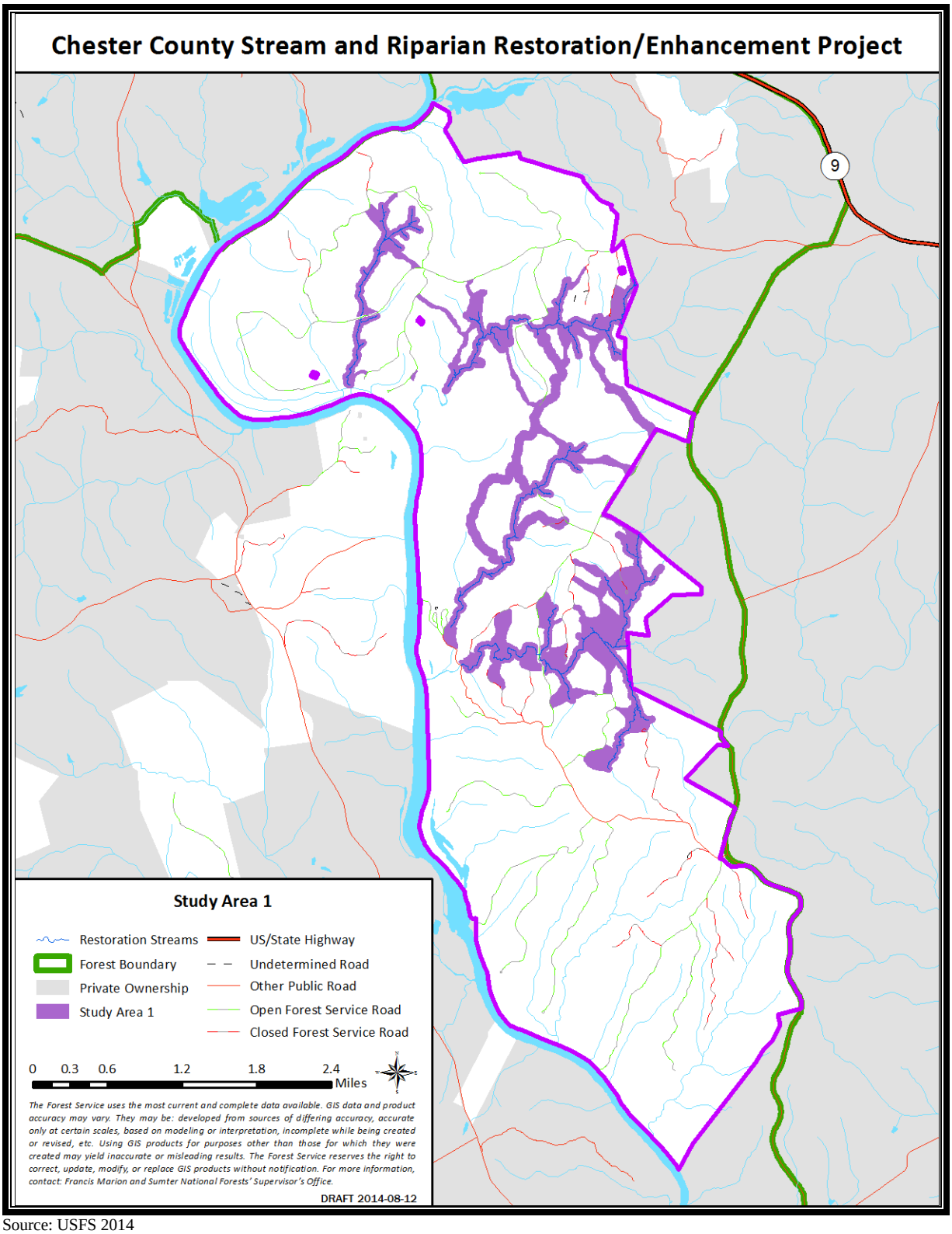
Within this chapter, there are references to the Project Area (11,605 acres), Study Area 1 and Study Area 2. The Project Area is located in the Southern Outer Piedmont ecoregion of the Piedmont Physiographic Province (Griffith et al. 2002 as cited in Atkins 2014) and includes the proposed restoration streams in the four watersheds in Chester County, South Carolina, as shown in Figure 1-1. The Project Area is situated approximately 2 miles south of the town of Lockhart, SC within the Lower Broad River watershed HUC 03050106 and is bounded by the Broad River to the west and Highway SC 49 (Woods Ferry Road) to the east.

Study Area 1 (Figure 3-1) is approximately 1,246 acres located within the Project Area. Study Area 1 comprises portions of four watersheds (Clarks Creek, Little Turkey Creek, McCluney Branch, and the unnamed tributary to Clarks Creek) ranging in size from 0.94 to 4.43 square miles. Three of the four watersheds (Clarks Creek, Little Turkey Creek, and McCluney Branch) flow directly to the Broad River, entering a 10-mile section of the Broad River that is impounded by the Neal Shoals dam and hydropower generating plant. The unnamed tributary to Clarks Creek evaluated in this analysis joins Clarks Creek less than 200 feet from its confluence with the Broad River (Atkins 2014). Study Area 1 also includes access corridors adjacent to the streams.

Study Area 2 (Figure 3-2) was developed after the Forest Service finalized Alternative 2-Proposed Action and includes 663 acres within the Project Area that are adjacent to the proposed restoration streams and include lands suitable for soil borrow and/or soil disposal. Only portions of the area analyzed for soil borrow and soil disposal would ultimately be used for this purpose.

The direct, indirect, and cumulative effects of Alternative 1-No Action and Alternative 2-Proposed Action are discussed for each resource affected in the Project Area. Throughout this Final EIS, “effects” and “impacts” are used synonymously. Impacts may be beneficial or adverse. Direct effects are effects to the particular resource (e.g., a soil type or specific specie) known or assumed to occur in the Project Area. Direct effects are caused by the Project activity and occur at the same time and place. Indirect effects are caused by the action and occur later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Cumulative effects results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (NEPA Guidelines). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Typical ongoing activities in the Project Area include timber harvesting, prescribed burning, wildlife habitat improvements and management activities, trail construction and maintenance, herbicide control of non-desirable species (including NNIS), road maintenance (i.e., culvert repair and replacement), and erosion control practices.



Source: USFS 2014

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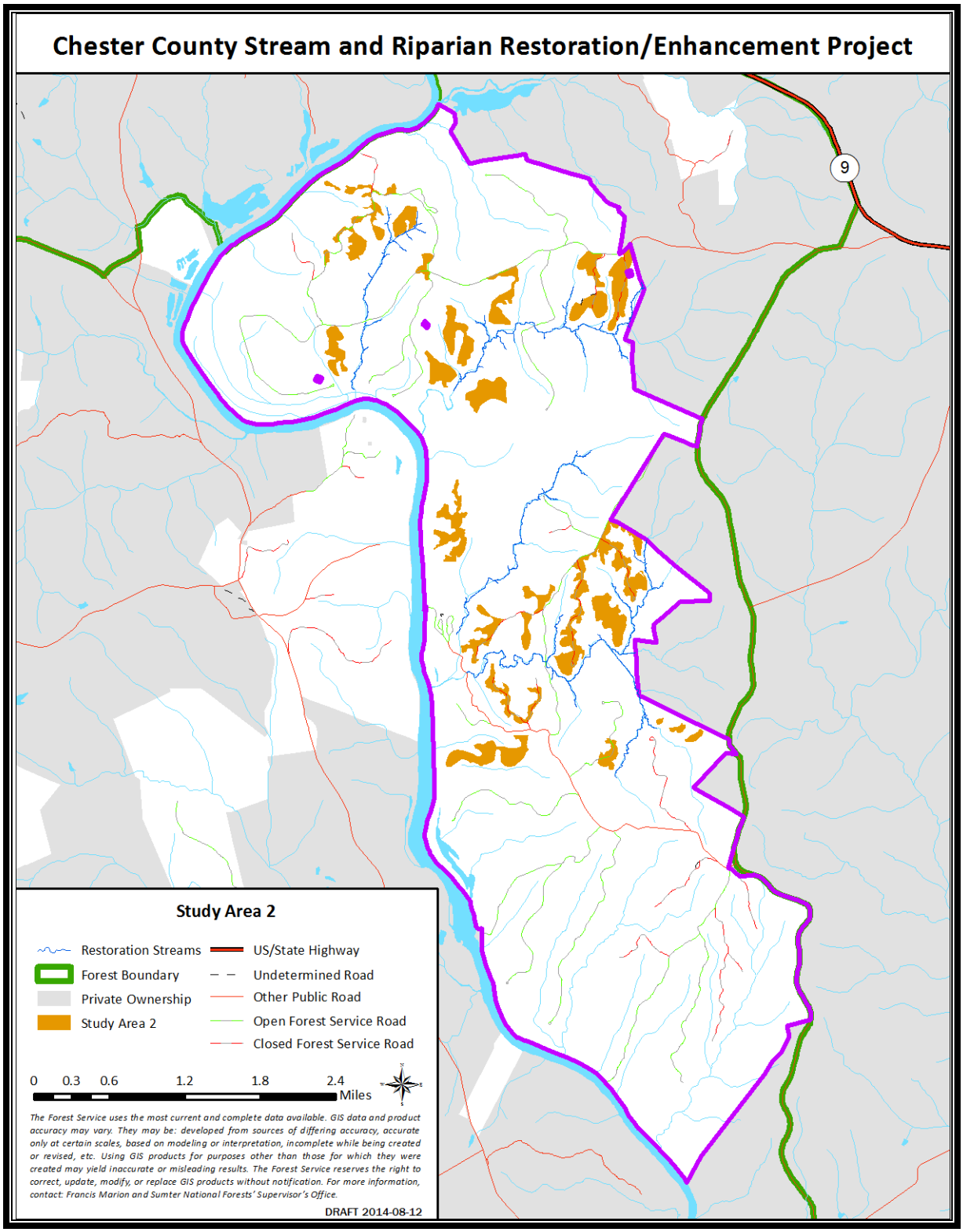
FIGURE 3-1: STUDY AREA 1



Source: USFS 2014

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FIGURE 3-2: STUDY AREA 2

3.2 GEOLOGY AND SOILS

3.2.1 *Affected Environment*

The proposed Project Area is located in the Southern Piedmont area of South Carolina, specifically the Carolina Zone of the Piedmont Physiographic province, a major geologic zone situated east of the southern Appalachians (Griffith et al. 2002 as cited in Atkins 2014; Hibbard et al. 2001 as cited in Atkins 2014). This description of geologic and soil resources with the Project Area is based primarily on Soil Survey of Chester and Fairfield Counties, South Carolina (USDA 1982), Forest Service soils data (US Forest Service 2014), and the Natural Resources Conservation Service (NRCS) Web Soil Survey (USDA 2014). Supplemental soil data were gathered through field reconnaissance within the area, and preliminary geotechnical data were collected during exploratory trenching (Atkins 2014).

3.2.1.1 Geology

The watersheds comprising the Project Area are underlain by the Charlotte terrane, in which plutonic rocks (i.e., large masses of intrusive igneous rock) predominate (Hibbard et al. 2001 as cited in Atkins 2014): Atkins (2014) observed granite, syenite, gabbro, diorite, and diabase dikes, within several locations of the Project Area. Metamorphic rocks are common within the Charlotte terrane, including gneiss, schist, quartzite, and phyllite. Upland soils derived from weathering of these generally acid crystalline parent material rocks typically exhibit a deep mantle of erosion-prone saprolite and 1:1 red kaolinitic clay mineralogy (Griffith et al. 2002 as cited in Atkins 2014; USDA 1982 as cited in Atkins 2014). Most soils within the Southern Piedmont derive from either slate or felsic and basic crystalline rock, including the Cecil, Appling, Madison, and Wilkes series and associated soils.

3.2.1.2 Topography

Topography within the Project Area is rolling to hilly, with linear ridges dissected by intermittent drainage pathways (Atkins 2014). Streams tend to have moderate and sometimes slightly higher gradients in high landscape positions; lower gradients are observed along larger, lower-relief drainages. Stream drainage systems are dendritic and tend to be perpendicular to the structural trend of the rocks across which they flow (Griffith et al. 2002 as cited in Atkins 2014). First-order streams in the Piedmont generally flow through surface soils that overlay saprolite. Second and higher-order streams generally have cut down through the saprolite into weathered rock and bedrock, and the depth of incision increases with stream order (Costa and Cleaves 1984 as cited in Atkins 2014), and these observations are generally consistent with those observed in the Project Area. Elevations within the Project watersheds range from a high of approximately 674 feet National Geodetic Vertical Datum (NGVD) along ridge tops to a low of approximately 300 feet NGVD within the Broad River floodplain.

3.2.1.3 Soil History and Regional Context

The Southern Piedmont is one of the most severely eroded areas in the United States, which is manifested by widespread gullying in uplands and abundant sediment deposition in stream valleys. Extensive landscape-scale erosion of upland soil in the Southern Piedmont (including in the Project Area) began in the late 1700s, as forested areas were converted to larger scale agricultural operations, primarily cotton. This conversion, which coincided with

poor soil conservation practices, reached a maximum intensity between 1860 and 1920). In some areas of the Southern Piedmont, sediment overwhelmed valley bottoms, reaching depths of up to 12 feet as it buried bridges, mills, and other structures (Trimble 1974 as cited in Atkins 2014). Soil conservation measures and agricultural BMPs developed in the 1940s led to a dramatic reduction in agriculturally derived erosion across the region (Merritts et al. 2006 as cited in Atkins 2014).

The Woods Plantation, established in 1817, was located on the Broad River in the area near Woods Ferry boat landing. During its operation, much of the plantation was heavily logged and farmed for cotton. Erosion on the plantation became widespread and significantly affected the productivity of farming. In 1936, the federal government acquired the land in and around the Woods Plantation that currently makes up much of the Project Area. The land has been managed by the Forest Service since acquisition. At that time, the Forest Service began extensive erosion control and reforestation work that continues today (Atkins 2014).

Exploration of sediment depths indicates that the stream valleys are dominated by colluvial processes, with hillslope erosion associated with historical cotton production leading to the accumulation of sediments on the historic floodplain. Through exploratory digging, Atkins (2014) found that the depth of the accumulated sediment in all four Project watersheds varies from 1 foot to 8 feet; detailed exploratory trenching at one floodplain within McCluney Branch and the unnamed tributary to Clarks Creek suggests that the more recent sediments are relatively shallow (<2.5 feet) and at the lower end of the initially observed range. Actual depths in Little Turkey Creek and Clarks Creek will be determined through additional geotechnical investigations.

3.2.1.4 Channel Incision

Over time, reductions in soil erosion brought about by changes in land use and implementation of conservation practices in the mid-1900s by the Forest Service and others resulted in a decrease in sediment delivery to stream channels. With less sediment reaching the stream channels, farmers again tried to use this land by straightening or relocating channels. At this early stage, the valleys were more or less swamps or braided networks, overloaded with sediment. The ditching of streams and farming in valleys confined stream flow and resulted in rapid incision down through the recently deposited legacy sediments and a loss of or reduction in floodplain connectivity (James 2006 as cited in Atkins 2014: Ruhlman and Nutter 1999 as cited in Atkins 2014: Trimble 1974 as cited in Atkins 2014). Channels within Study Area 1 have downcut below the historic channel elevation to bedrock (Jennings. J. 2012, personal communication; Atkins 2014). The incision left a small active channel inset between fine-grained, paired terraces that are saprolite (Figure 3-3) between 12 feet and 60 feet apart. Channel incision resulted in the conversion of the higher valley flat of deposited sediment (interpreted here as the fill terrace) to a well to somewhat well-drained upland forest. Many of these abandoned terraces have been able to maintain their general riparian character or appearance, despite the reduction in their hydroperiod and water tables by the stream gullies, because rainfall is well distributed through the year. Large volumes of sediment are released from storage in the fill terrace as rapid channel incision in the headwaters and upper reaches progresses, fill-terrace scarps undergo mass failures (undercuts and slumps), gullies form, and lateral channel migration occurs. Freeze thaw and severe

storm events also contribute to erosion of exposed banks and sediment delivery from hillslope gullies (Hansen and Law 2004). Most of the entrained fluvial sediment is sand and is temporarily stored in the channel bed or in long, alternating side bars. The lack of floodplain development at the current channel elevation limits the amount of sediment storage in an active floodplain (Atkins 2014).

Source: Kleinschmidt 2014

FIGURE 3-3: DEEP CHANNEL INCISION THROUGH SAPROLITE AND HISTORIC FLOODPLAIN SOILS

As the stream channels continue to widen/erode the fill terrace (i.e., abandoned historic floodplain at higher elevation) and build new active floodplains at a lower elevation, the consequence is a tremendous sediment flux delivered to lower stream reaches and the Broad River. Similar observations of channel response in the Piedmont of South Carolina have been documented on Storm Creek by James (2006, 2011 as cited in Atkins 2014); and on tributaries of the Upper Oconee River in Georgia by Ruhlman and Nutter (1999 as cited in Atkins 2014).

The valley floor is underlain with bedrock and bedrocks sills, usually at a depth of 4 to 15 feet below the fill-terrace elevation, and bedrock sill morphology is evident in the upper and

middle reaches of Clarks Creek, unnamed tributary to Clarks Creek, and Little Turkey Creek (Atkins 2014). Channel incision has exposed these immobile bedrock sills, which function as grade control, preventing the channel from further downcutting. Unconsolidated material is often scoured from around a sill, causing the bedrock to project 1.5 to 3 feet above bordering channel elevation. The larger sills often function as channel sediment traps with very little bed-load throughout, resulting in longitudinal discontinuity in sediment transport. In some cases, the large-scale aggradation of fine gravel and sand upstream of sills has buried previously existing pools or riffles and left a sandy plane bed with little complexity and of poor ecological value. In other instances, the channel coarsens considerably immediately downstream from these sills in response to an increase in slope and where sill fragments serve as a source of coarse material (Atkins 2014).

Lower stream reaches in the watersheds show a very different phase of channel response (Atkins 2014). Channel incision lessens as stream reaches approach the Broad River floodplain. The sediment supply to these reaches, exported from the headwater reaches as they cut downward through the fill terraces, exceeds their ability to transport material, and sediment aggradation occurs. The lower reach of the unnamed tributary to Clarks Creek spreads onto a broad floodplain of smaller channels, depositing its sediment load during overbank flows.

Streams in the Project Area are still actively responding to historic land use changes. Many processes are active over time that contribute to erosion complexity, severity and episodic behavior. If subject only to natural processes, the legacy of accelerated soil erosion rates will be present on the landscape and especially within these unstable channels over a long period of time. Sediment previously eroded from surrounding Piedmont uplands is currently stored in the fill terraces on the valley floors. During high-flow events, erosional stress is applied to streambanks, mobilizing stored sediments. Finer sediment fractions are transported as suspended load into the Broad River; the coarse sediment is transported as bedload, and deposited downstream in the channel or on developing floodplains.

3.2.1.5 Soil Descriptions

The Forest Service mapped soils within the Project Area as depicted in Figure 3-4 through Figure 3-7, which highlight soils in Study Area 1, and Figure 3-8 through Figure 3-11 highlight soils in Study Area 2. The U.S. Department of Agriculture (USDA) NRCS mapped supplemental data on soils beyond the Forest Service boundary. The following sections describe each of the soil series found in Study Area 1 and Study Area 2 (Forest Service 2014; USDA 1982 and 2008). Figure 3-8, Table 3-1, and Table 3-2 provide data regarding the proportion of each mapped soil series within the four watersheds. Notations on erosion hazard relate to erosion of the surface soils and not the soils' susceptibility to instream bank erosion, which can be affected by many interrelated factors.

The Appling series consists of very deep, well-drained, moderately permeable soils on broad, nearly level to gently sloping ridges and on sloping to moderately steep sides of ridges between intermittent and permanent streams. The soils are moderately permeable and have moderate capacity to store water. The soils contain little organic matter and are strongly to

very strongly acidic. The soils are well suited for loblolly pine and yellow-poplar. Erosion is a slight hazard.

The Cartecay series consists of somewhat poorly drained, moderately permeable soil that formed in thick, loamy alluvial sediments. This soil has a dark brown loamy surface layer about 9 inches thick and brownish loamy stratified C horizons that are mottled with gray. The soil contains a moderate to small amount of organic matter. It is slightly acid to strongly acidic. The soil is good for yellow poplar, cottonwood, loblolly pine, and sweetgum. Erosion hazard is low.

The Cataula series consists of deep, well-drained, slowly permeable, clayey soil on ridge tops and short side slopes at the head of and adjacent to shallow drainages. The soil has a dense, brittle layer that restricts root penetration and water movement. The soil contains little organic matter. It is moderately to very strongly acidic. The soil is fairly suitable for loblolly pine and yellow poplar. Erosion hazard is severe.

The Cecil series consists of deep, well-drained, sloping soil on medium and broad, irregularly shaped ridgetops. In cultivated areas, the surface layer is a mixture of topsoil and subsoil. Slopes are smooth and convex, and the unit contains some small areas with cobblestones and boulders on the surface. The permeability is moderate. The soil contains little organic matter and is strongly acidic or very strongly acidic. The suitability is good to fair for loblolly pine and yellow poplar. Erosion hazard is moderate.

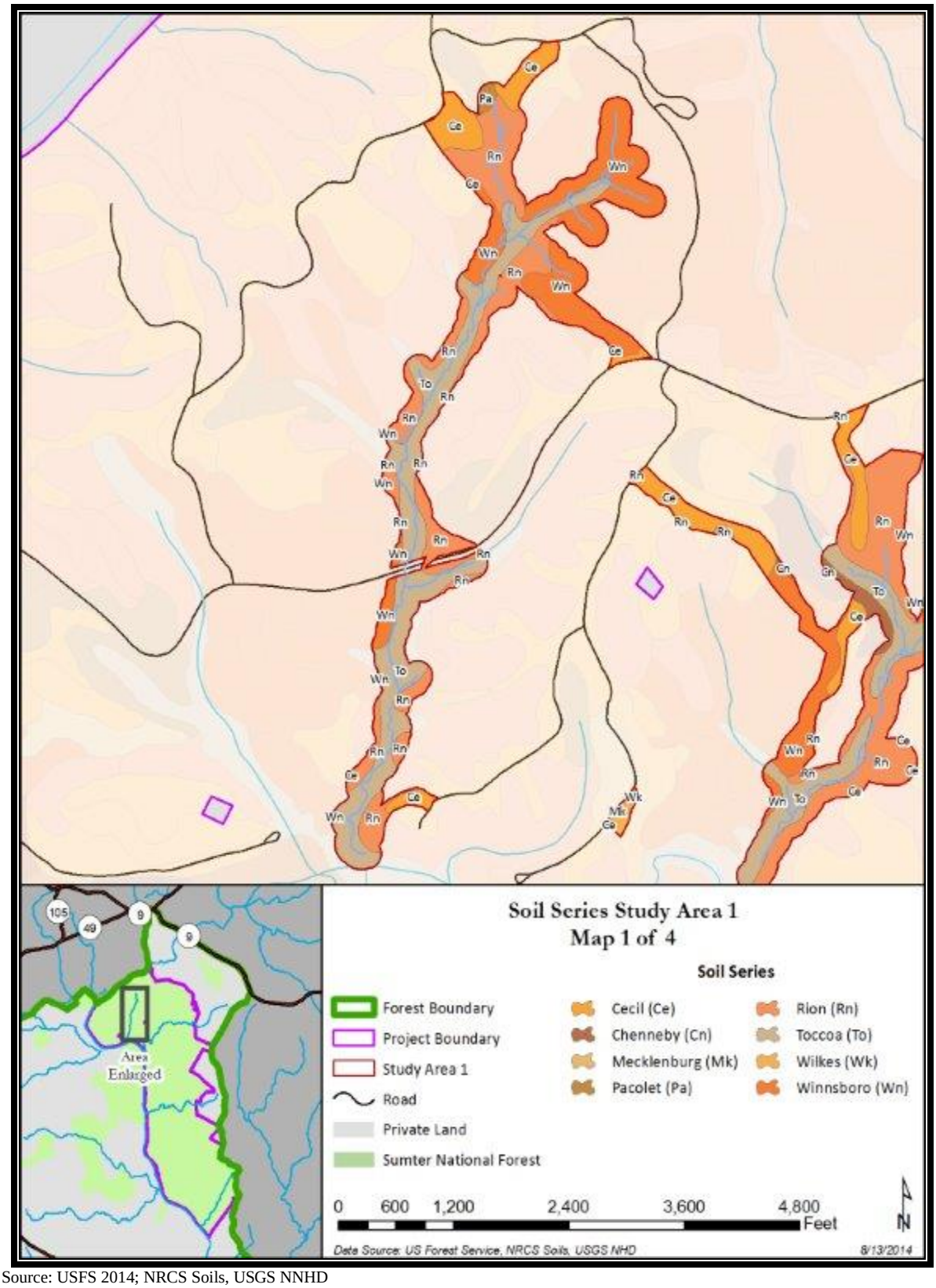
The Chenneby series consists of very deep, somewhat poorly drained, moderately permeable soil that formed in loamy and silty sediments on flood plains. Plant roots penetrate the very deep soil easily. The soil contains a moderate to small amount of organic matter and is strongly acidic or very strongly acidic. The suitability is good to fair for loblolly pine and yellow poplar. Erosion hazard is slight.

The Chewacla series consists of deep, somewhat poorly drained, nearly level soils found along floodplains and perennial streams. These soils are commonly flooded for brief periods from November to April. The soils have moderate permeability and a large available capacity to store water. The soils contain a moderate to small amount of organic matter and are mildly acidic to very strongly acidic. The soils are good for yellow poplar, cottonwood, loblolly pine, and sweetgum. Erosion hazard is slight.

The Madison series consists of deep, well-drained soils found on ridges and broad side slopes. Slopes range from gently sloping to moderately steep. Permeability is moderate, and the available capacity to store water is medium. The soils contain little organic matter and are strongly acidic or very strongly acidic. The soils are good to fair for loblolly pine and yellow poplar. Erosion is a severe hazard.

The Mecklenburg series consists of deep, well-drained, soil on narrow to broad ridges and their associated side slopes which are adjacent to drainageways. Slopes are smooth and convex. The clayey soils are slowly permeable. Mottling is common is deeper soil horizon

and the soil is mildly acidic or strongly acidic. The soil is moderately suited for loblolly pine and yellow poplar production. Erosion hazard is moderate.



Source: USFS 2014; NRCS Soils, USGS NNHD

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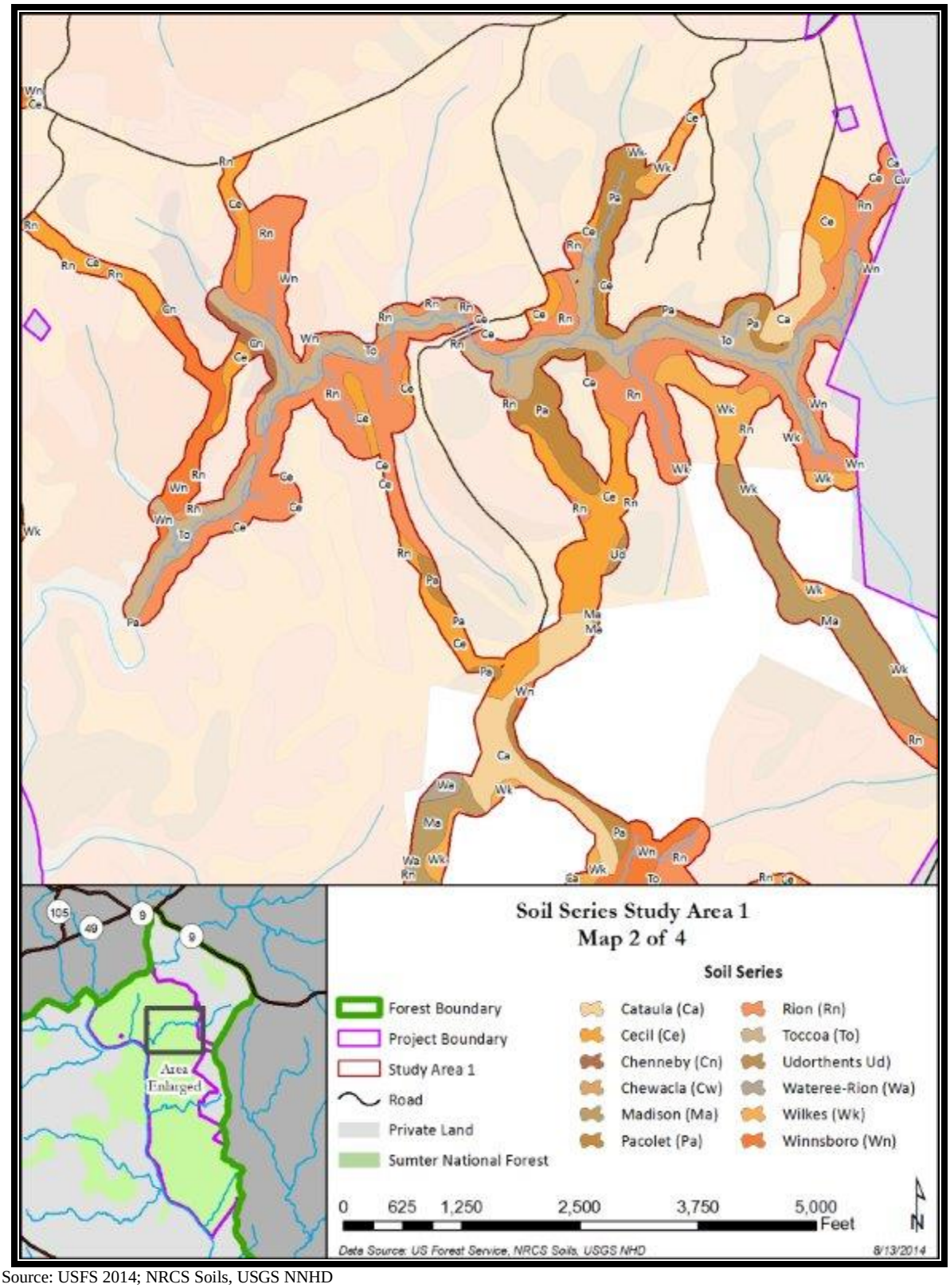
FIGURE 3-4: SOIL SERIES STUDY AREA 1 MAP 1



Source: USFS 2014; NRCS Soils, USGS NNHD

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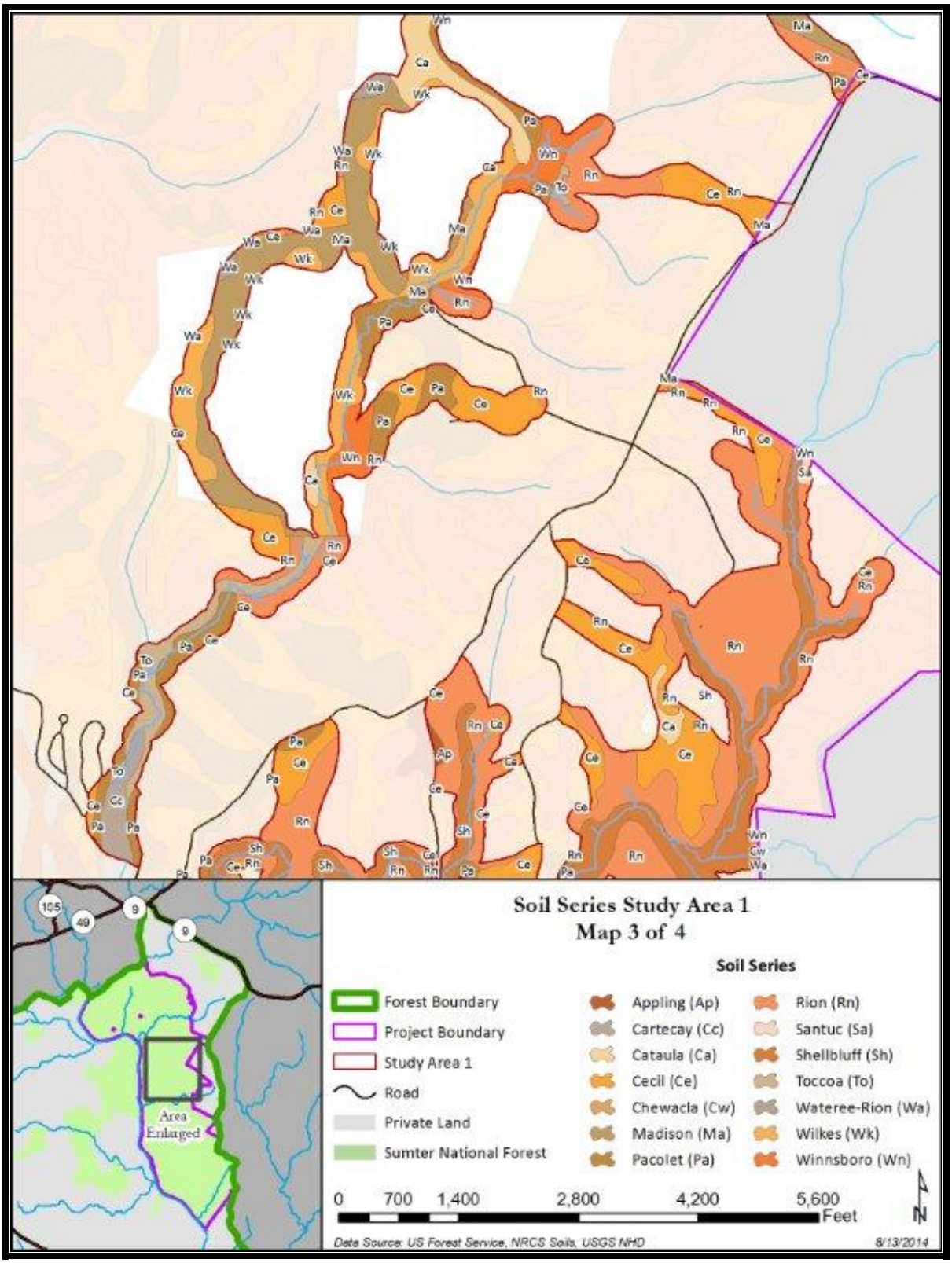
FIGURE 3-5: SOIL SERIES STUDY AREA 1 MAP 2



Source: USFS 2014; NRCS Soils, USGS NNHD

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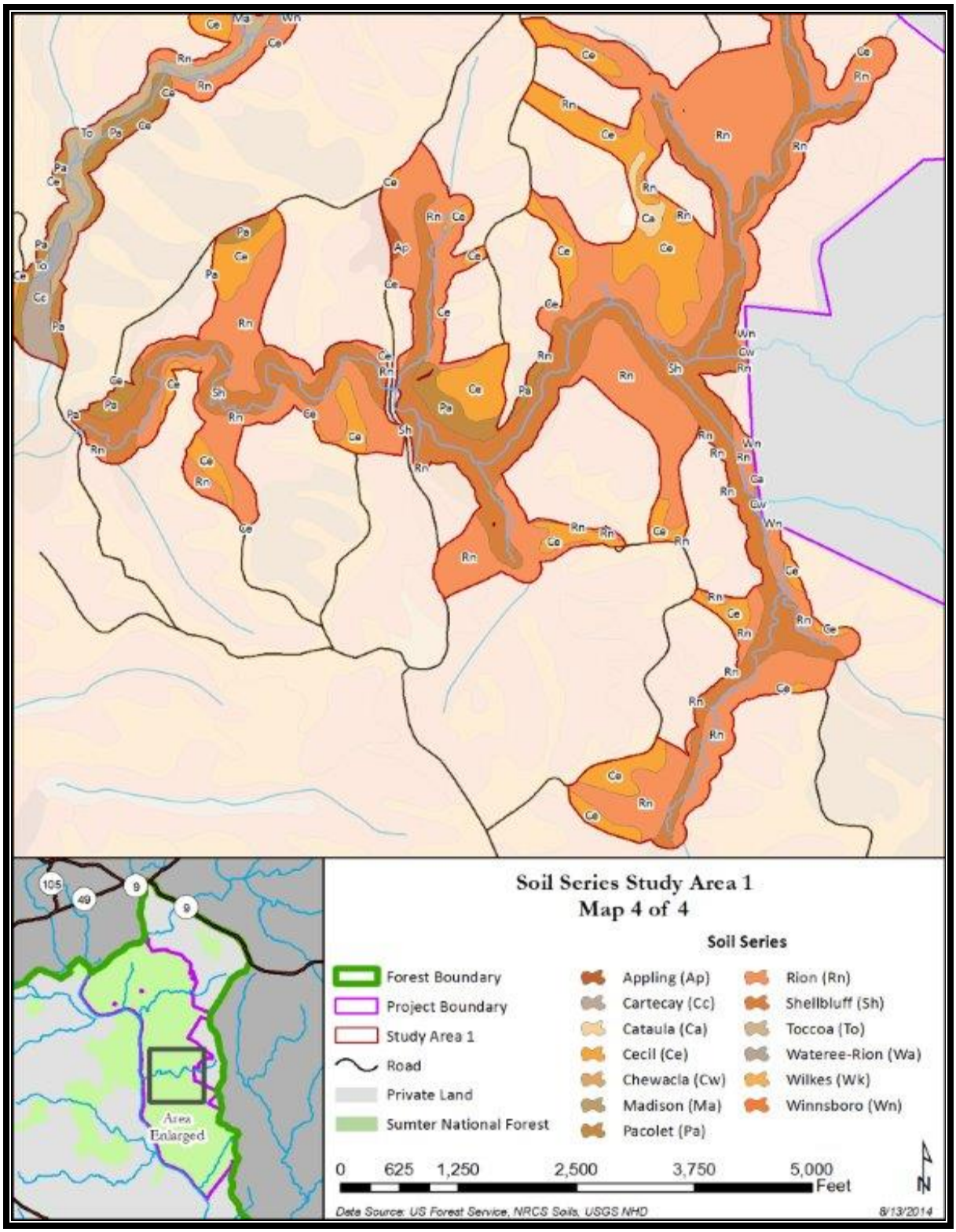
FIGURE 3-6: SOIL SERIES STUDY AREA 1 MAP 3



Source: USFS 2014; NRCS Soils, USGS NNHD

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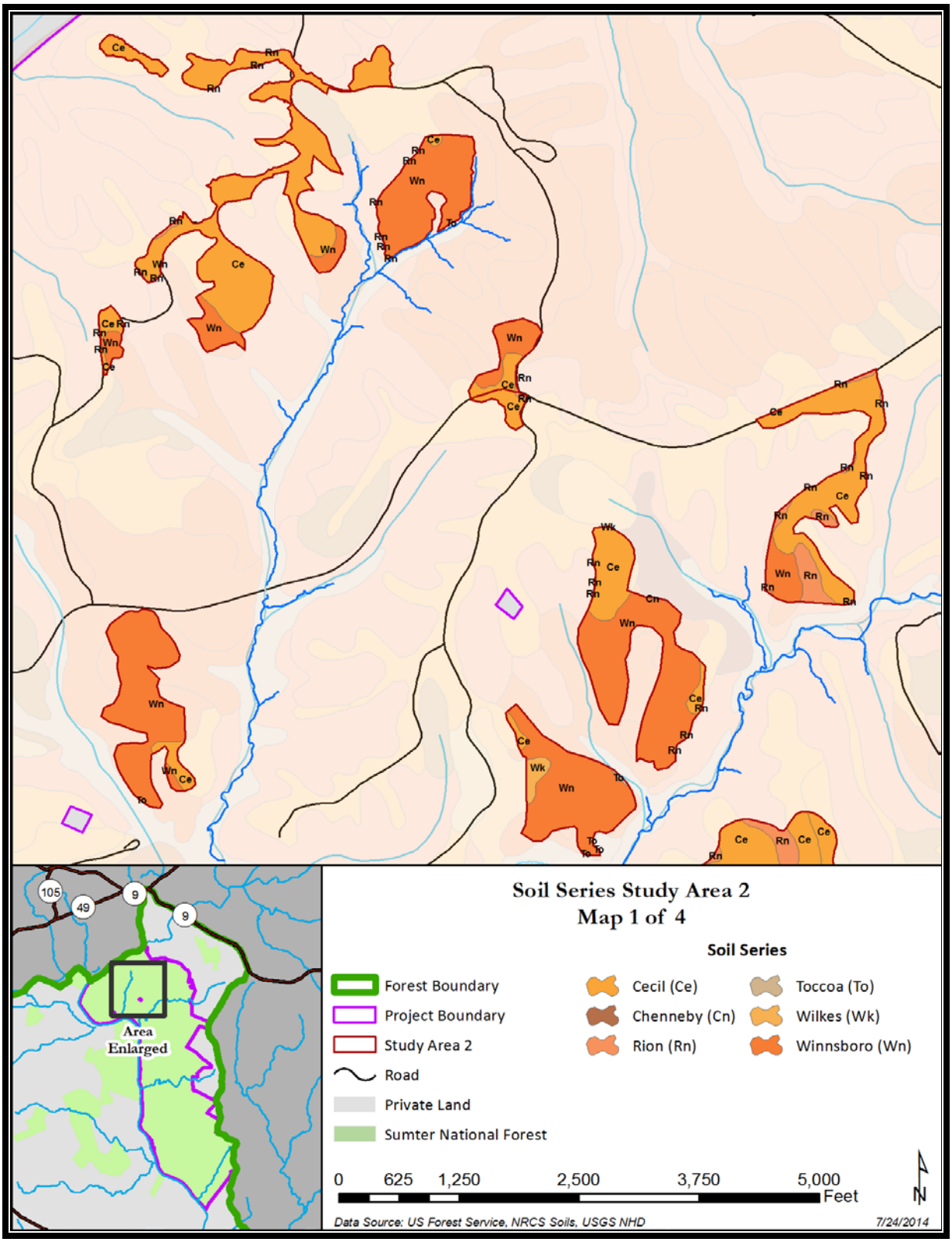
FIGURE 3-7: SOIL SERIES STUDY AREA 1 MAP 4



Source: USFS 2014; NRCS Soils, USGS NNHD
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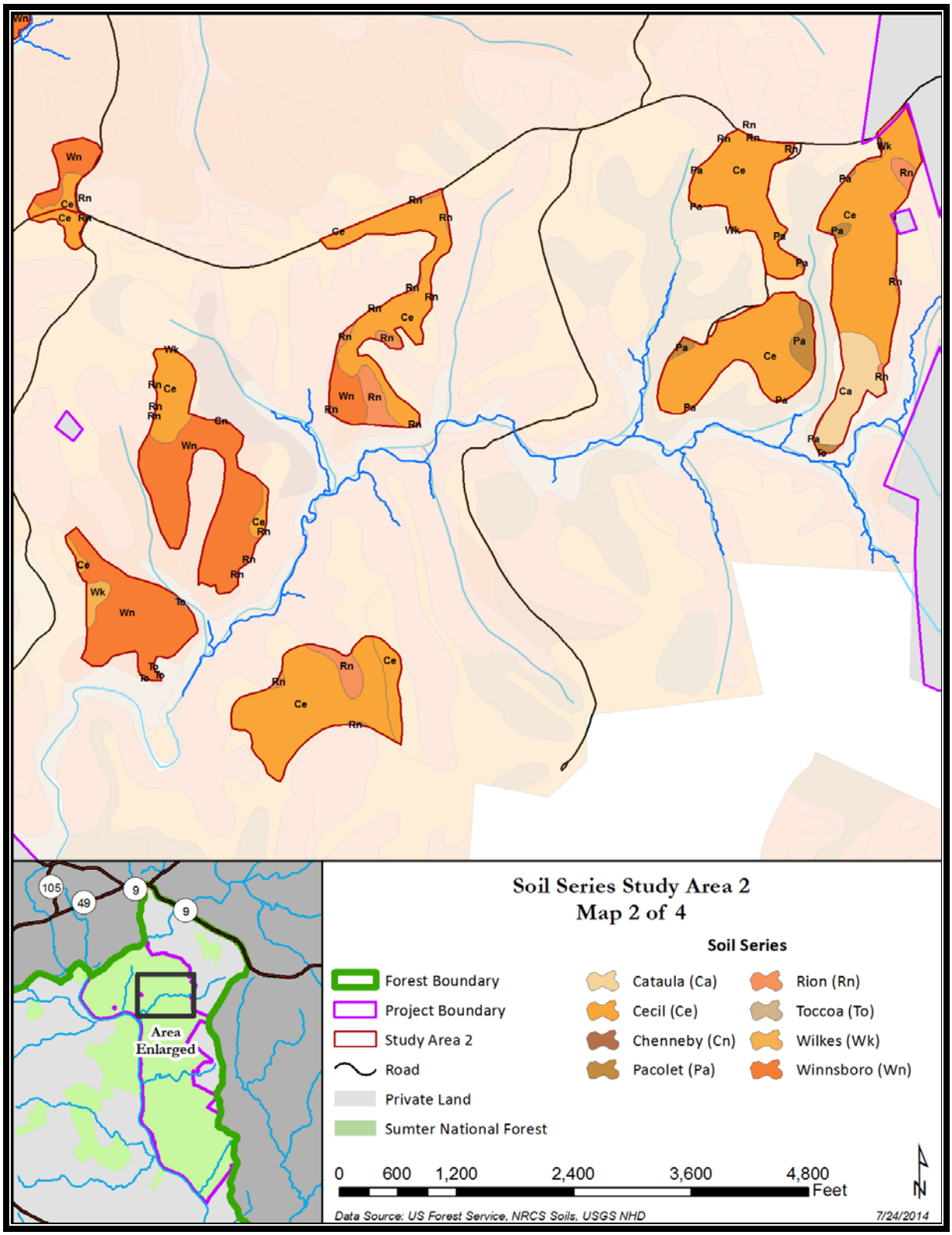
FIGURE 3-8: SOIL SERIES STUDY AREA 2 MAP 1



Source: USFS 2014; NRCS Soils, USGS NNHD

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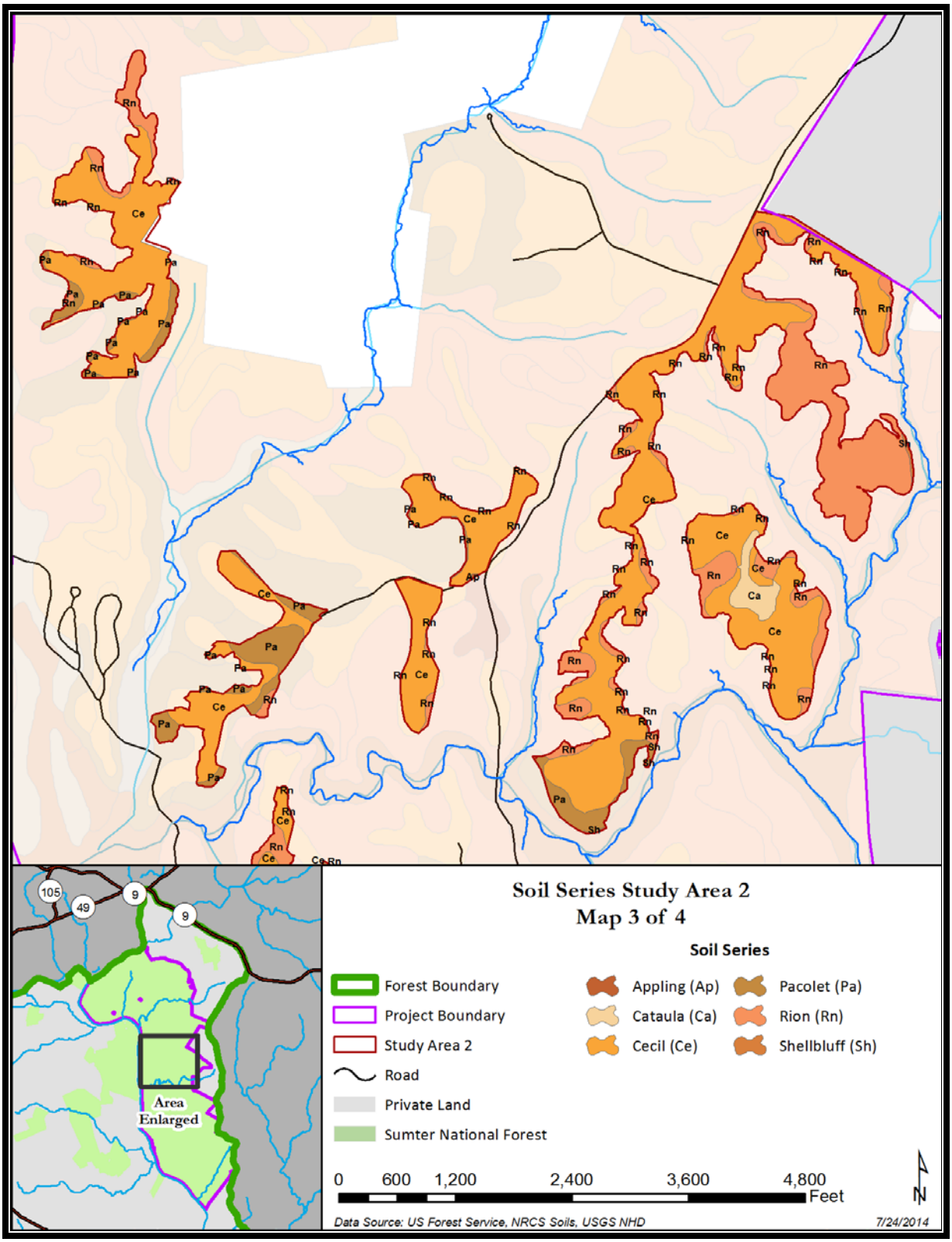
FIGURE 3-9: SOIL SERIES STUDY AREA 2 MAP 2



Source: USFS 2014; NRCS Soils, USGS NNHD
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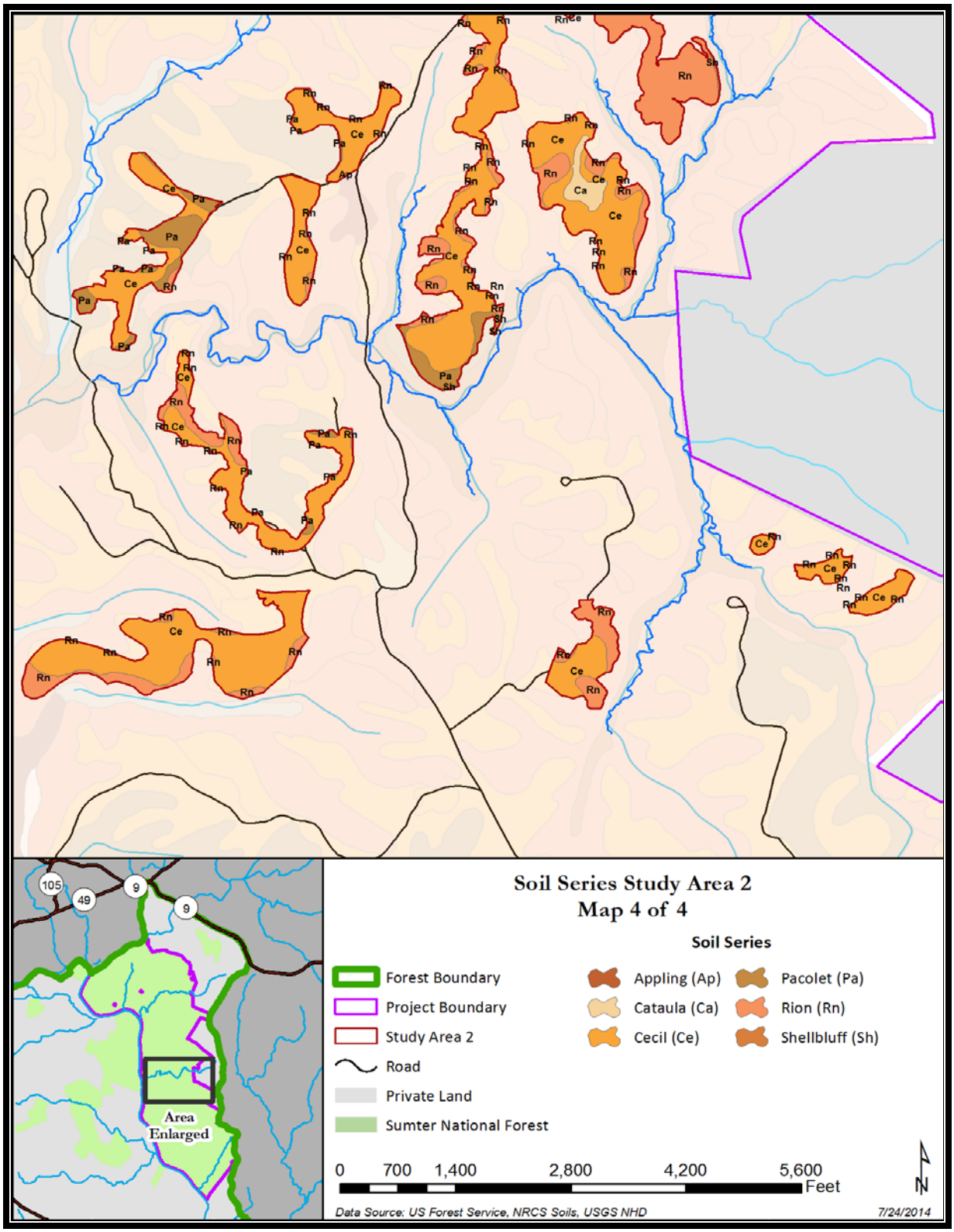
FIGURE 3-10: SOIL SERIES STUDY AREA 2 MAP 3



Source: USFS 2014; NRCS Soils, USGS NNHD
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FIGURE 3-11: SOIL SERIES STUDY AREA 2 MAP 4

TABLE 3-1: SOILS WITHIN STUDY AREA 1*

Soil Data	Acres	Percent of Area
Clarks Creek	**498.6**	**40.1%**
Appling	1.2	0.1%
Cataula	3.2	0.3%
Cecil	93.5	7.5%
Chewacla	0.5	0.0%
Madison	0.3	0.0%
Pacolet	12.0	1.0%
Rion	252.7	20.3%
Santuc	0.9	0.1%
Shellbluff	133.7	10.7%
Wateree-Rion	0.0	0.0%
Winnsboro	0.5	0.0%
Lower Turkey Creek	**331.2**	**26.6%**
Cataula	10.9	0.9%
Cecil	59.8	4.8%
Chenneby	3.2	0.3%
Chewacla	0.7	0.1%
Madison	18.3	1.5%
Mecklenburg	0.3	0.0%
Pacolet	29.5	2.4%
Rion	107.2	8.6%
Toccoa	67.0	5.4%
Udorthents	0.9	0.1%
Wilkes	21.6	1.7%
Winnsboro	12.0	1.0%
McCluney Branch	**130.0**	**10.5%**
Cecil	11.9	1.0%
Pacolet	1.1	0.1%
Rion	38.2	3.1%
Toccoa	43.4	3.5%
Winnsboro	35.4	2.8%

Soil Data	Acres	Percent of Area
Unnamed Tributary to Clarks Creek	**283.9**	**22.8%**
Appling	0.0	0.0%
Cartecay	8.2	0.7%
Cataula	20.5	1.6%
Cecil	37.6	3.0%
Madison	57.6	4.6%
Pacolet	38.5	3.1%
Rion	36.0	2.9%
Toccoa	17.0	1.4%
Wateree-Rion	3.0	0.2%
Wilkes	44.7	3.6%
Winnsboro	20.8	1.7%
Total for Study Area 1	**1,243.6**	**100.00%**

Source: Forest Service 2014; USDA 1982 and 2008
*Note: Project Streams and Proposed Access Corridors Only

TABLE 3-2: SOILS WITHIN STUDY AREA 2

Areas	Acres	Percent of Area
Borrow	**24**	**4.5%**
Cecil	1.9	7.8%
Winnsboro	22.4	92.2%
Borrow/Disposal	**453**	**83.9%**
Cataula	12.7	2.8%
Cecil	351.6	77.6%
Pacolet	18.5	4.1%
Rion	0.3	0.1%
Winnsboro	69.8	15.4%
Disposal	**62**	**9.4%**
Appling	0.1	0.1%
Rion	60.8	97.9%
Wilkes	1.2	2.0%
Expansion for Plant Survey	**123**	**18.6%**
Cataula	1.1	0.9%
Cecil	68.5	55.6%
Chenneby	0.1	0.1%
Pacolet	8.2	6.7%
Rion	31.4	25.5%
Shellbluff	0.5	0.4%
Toccoa	0.3	0.2%
Wilkes	0.7	0.6%
Winnsboro	12.4	10.0%
Total for Study Area 2	**663**	**100.00%**

Source: Forest Service 2014

The Pacolet series consists of deep, well-drained, strongly sloping to moderately steep soils found on convex slopes adjacent to drainages. Permeability is moderately rapid to rapid, and available water capacity is high. The soils contain little organic matter and are moderately acidic to very strongly acidic. The soils are moderately suited for loblolly pine and well suited for yellow poplar. Erosion is a severe hazard.

The Rion series consists of very deep, well-drained, moderately permeable soil that formed on narrow ridges and side slopes adjacent to drainageways. Slopes are generally smooth and convex and range from gently sloping to very steep. Permeability is moderately rapid. The soil contains a small to moderate amount of organic matter and is moderately acidic to very strongly acidic. The soil is well suited for loblolly pine and yellow poplar. Erosion is a severe hazard.

The Santuc series consists of very deep, moderately well-drained soil that formed on narrow ridges and side slopes adjacent to drainageways. The soil has medium to rapid runoff and moderately slow permeability. The soil contains a small to moderate amount of organic matter and is strongly acidic to extremely acidic. The soil is well suited for loblolly pine and yellow poplar. Erosion is a moderate hazard.

The Shellbluff series consists of very deep, moderately well-drained soils found in nearly level areas on first bottoms along streams. The soils have moderate permeability. The soils contain a small to moderate amount of organic matter and are strongly acidic to extremely acidic. The soils are well suited for loblolly pine and yellow poplar. Erosion is a slight hazard.

The Toccoa series consists of very deep, moderately well-drained soils found in nearly level areas on first bottoms along streams. The soils can be flooded for brief periods. Soil permeability is moderately rapid. The soils contain a small to moderate amount of organic matter and are strongly acidic. The soils are well suited for loblolly pine and yellow poplar. Erosion is a slight hazard.

The Udorthents are well-drained, gently sloping to steeply sloping soil in areas that were formally gullied and that have been reclaimed by extensive grading. The graded material ranges in thickness from approximately 6 inches to several feet. This map unit is comprised of several soil soils, with dominant series consisting of Cecil and Pacolet soils. Because of variations in the depth of the cuts and fills during gully restoration, and the different soil types, all interpretations must be done on-site. The soil is moderately suited for loblolly pine and poorly suited for yellow poplar production. Erosion hazard is severe.

The Wateree-Rion complex series consists of an intricate mix of small areas of Wateree sandy loam (45 percent), Rion loamy sand (35 percent), and other soil units, including Winnsboro. Wilkes and Pacolet soils make up the remainder of the complex. The complex is found on narrow to broad, long, moderately steep to steep, convex side slopes. Permeability is moderate to moderately rapid, and available water capacity is low to medium. The soils contain little organic matter. The Wateree sandy loam soil is very strongly acidic to moderately acidic in the surface layer, and extremely acidic to moderately acidic in the subsoil and underlying material. The Rion sandy loam is moderately acidic to very strongly acidic. The series is fairly suitable for loblolly pine and yellow poplar. Erosion hazard is severe.

The Wilkes series consists of moderately deep, well-drained, sloping to steep soil on narrow ridges and broad, long, convex side slopes. Permeability is moderately slow, and available water capacity is low. The soil contains little organic matter. The soil is strongly acidic to slightly acidic in the surface layer and slightly acidic to mildly alkaline in the subsoil and underlying material. The soil has fair suitability for loblolly pine, post oak, southern red oak, and sweetgum. Erosion hazard is severe.

The Winnsboro series consists of deep, well drained, slowly permeable fine soil on gently sloping to moderately steep uplands. Soil permeability is slow, and the soil has a little

capacity to store water. The soil contains a small to moderate amount of organic matter and is strongly acidic. The soil is moderately suited for loblolly pine and yellow poplar. Erosion is a slight hazard.

For purposes of comparing alternatives, an estimate of sediment delivery to streams was prepared. Table 3-3 shows the estimated soil erosion occurring within the Project Area. The methods used to estimate soil erosion include those for land surface activities commonly applied (Hansen et al, 1994), and stream channel erosion estimates using the Bank Assessment for Non-point Source Consequences of Sediment (BANCS) model (Rosgen, 2006; Atkins 2014; USFS, et al. 2014). The soil erosion assumptions, background and calculations can be found in the Project file (*2014 Soil Erosion Calculations for the Chester County Stream and Riparian Restoration/Enhancement Project*). For hillslope and land surface activities, the 34 percent coefficient for sediment delivery is based on Roehl (1962) for the piedmont third and fourth order streams, and assumes that sediment that reaches streams is delivered through the reach. Sediment estimates produced by the bank erosion calculations were also assumed to be delivered to downstream stream reaches. In addition, estimates of total tons of sediment, mean sediment concentration and sediment delivery (tons/acre) are based on a 10-year period following full implementation.

TABLE 3-3: ESTIMATED SEDIMENTATION PRODUCTION WITHIN THE PROJECT AREA UNDER CURRENT CONDITIONS

	Units	Clarks Creek	Little Turkey Creek	McCluney Branch	Unnamed Tributary to Clarks Creek
Total Land and Streambank Erosion = 98,000 Tons/Decade					
Alt. 1- No Action	Tons/Decade	41,400	25,910	17,560	13,120
Estimated Mean Suspended Sediment Concentration for all Watersheds = 770 ppm/Decade					
Alt. 1- No Action	ppm/Decade	770	640	1,550	610
Annual Total Sedimentation, normalized by Stream Length = 0.102 Tons/Foot/Year					
Alt. 1- No Action	Tons/foot//Year	0.109	0.105	0.114	0.075

ppm = parts per million

3.2.2 *Direct and Indirect Effects of Alternative 1-No Action*

Geology, hence soil, is an underlying, controlling variable in the Stream Functions Pyramid (Harman et al. 2012). Historic land clearing and agriculture practices affected the hydrology of the watershed, and reduced vegetative cover resulted in increased volumes of stormwater runoff moving at faster velocities. The stormwater runoff severely eroded the susceptible soil and deposited it in lowland areas and in the stream channels, where it accumulated. In addition, many farmers moved streams to the slope margins or straightened stream sections to improve cultivation and reduce flooding (Happ 1945; Trimble 1974). These activities also increased water yield (Swank et. al. 1988). Forestation of the stream valleys following the cessation of agricultural activities has helped to stabilize soil considerably, in part because evergreen trees transpire approximately 30 inches of water annually, hardwood trees

transpire approximately 20 inches annually, and grasses transpire approximately 10 inches annually (Swank et.al. 1988). Perhaps more importantly, hydrologic function is likely to be improving incrementally within the watersheds under current conditions in comparison to the overwhelming severity of the past. In addition, the Forest Service's long-standing efforts to control hillslope gullies has helped reduce sediment loading. As such, relationships between channel-forming discharge and precipitation/runoff appear to be moving towards a more functional state.

Streams within the Project Area, however, are deeply entrenched in their valleys and in the early stages of recovering from the massive historical accumulation of sediment from gullied hillslopes. To a substantial existing, the entrenchment, containment, and confinement of the stream gully channels focused substantial stream energy into degradation forces that have eroded well below historic or legacy sediment, locally through prehistoric surfaces to bedrock. Consequently, natural and human-induced soil disturbance due to dysfunctional stream and watershed processes that produce sediment is expected to continue at its currently excessive rate of 98,000 tons/decade. Under Alternative 1-No Action, deposition of sediment from headwaters and mid-watershed stream reaches would continue to negatively affect downstream areas. In addition, lower ground water tables result from channel incision, which in turn negatively affects wetland hydrology and soil moisture conditions within riparian areas and the valley bottom.

Alternative 1-No Action also has lost opportunity costs in that the considerable ecosystem benefits to streams, wetlands, and riparian areas associated with Alternative 2-Proposed Action would not occur.

3.2.3 *Cumulative Effects of Alternative 1-No Action*

No new soil disturbing activities are proposed under Alternative 1-No Action. The direct and indirect effects of historical land use activities, and the forest management activities currently underway on national forest system lands, would continue. As shown in Table 3-5, the total estimated land and stream erosion is expected to continue at its excessive rate of 98,000 tons/decade. Current forest management activities, which are implemented under the standards for protecting soils listed in the Forest Plan (USFS 2004a), are approximately 7,140 tons/decade, which is only a small fraction of that total. As such, the cumulative effects from these forest management actions are minimal compared to the larger contribution of sediment from the watershed. Activities on private lands were included with these estimates based on land use specific to those private lands and added an 2,500 tons/decade of sediment; therefore, the additional 2,500 tons/decade is a very diminutive amount of sediment relative to the existing excessive rate of 98,000 tons/decade.

3.2.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

Alternative 2-Proposed Action involves landscape-scale restoration of streams within four watersheds. The proposed restoration would directly improve the hydrologic function of streams by raising local water tables and hydrating valley bottoms, as well as restoring wetland hydrology that would support surface water retention and groundwater recharge. In addition, benefits for the higher-level functions within the Stream Functions Pyramid (i.e., hydraulic function and geomorphologic function as described in Section 2.1) would help

to protect the soil resource by reducing erosion. For soil resources, the effects of both the restoration and the connected actions are discussed jointly.

Stream restoration involves various types and intensities of ground disturbing activities that can affect the soil. Stream restoration can directly affect the physical, chemical, and biological properties of the soil. Effects of Alternative 2-Proposed Action may include immediate changes in soil erosion and compaction, water infiltration rates, soil moisture conditions, and stabilization of stream channels. Excavation in and adjacent to the stream channel and in nearby soil borrow and disposal areas represents the primary concern regarding soil.

Implementation of the restoration approaches will involve borrowing soil to raise the streambed elevation for P1-floodplain reconnection, and disposal of excess soil generated during excavation associated with P2-floodplain excavation and P3-floodplain benches. To minimize environmental impacts, construction time, and cost, considerable efforts would be made to minimize the distance soils are moved during construction, reusing material in nearby locations where practical, obtaining borrow material locally, and disposing excess material near the locations where it is generated. In many cases, it may be feasible to move material within a watershed; however, some material may be moved between watersheds given the proximity of the work areas. Estimates of soil borrow and spoil volumes needed for the proposed restoration work are located in Table 3-4.

TABLE 3-4: ESTIMATES OF SOIL BORROW AND SPOIL VOLUMES NEEDED FOR PROPOSED RESTORATION

Watershed	**Excavation** (CY)	**Fill** (CY)	**Net Change** (CY)	**Note**
McCluney Branch	5,200	44,100	(39,000)	Borrow needed
Little Turkey Creek	77,100	93,100	(16,000)	Borrow needed
Clarks Creek	284,600	144,900	139,700	Spoil excess soil
UT to Clarks Creek	27,500	0	27,500	Spoil excess soil
Project Total	*394,400*	*282,100*	*112,200*	*Spoil excess soil*

Source: EPR 2014
CY: cubic yard

Specific concerns associated with excavation and connected actions include rutting, soil compaction, displacement/erosion, and soil exposure. Soil disturbance and compaction during stream restoration would vary depending upon both the type of soil and the construction method. In areas where P2-floodplain excavation, P3-floodplain benches, or soil borrow occurs, substantial disturbance of the top 3-feet to 4-feet of soil occur after trees and stumps have been removed. However, the soil borrow or soil disposal locations were selected because they have characteristics beneficial to the Project. For example, soils that have higher clay content would be borrowed because they can be used to help fill abandoned stream channel segments, and excess soils could be placed in areas with a low-to-moderate soil site index due to past erosion. As such, the effect of disturbance is expected to be

minimal. Spreading streambank and riparian soils rich with organic material in soil disposal area may actually increase site productivity and support desirable native plant communities following restoration planting.

Alternative 2-Proposed Action would reconnect the streams to the forested floodplain, thereby providing a broad array of benefits. Re-establishing floodplain connectivity would enable floodwaters to access overbank areas, leading to improved nutrient reduction and nutrient cycling (e.g., saturated soils remove more nitrogen in denitrification processes) in streambank and riparian areas. The floodplain would attenuate overbank flows, reducing peak flood stage and increasing saturation of the floodplain soils. Saturated floodplain soils would increase the potential for local groundwater recharge, which could improve baseflow contributions to stream discharge and reduce instream water temperatures. In addition, saturated floodplain soils could support hydrophytic (i.e., wetland) vegetation and result in the development additional hydric soils.

Estimates of soil erosion indicate that implementing Alternative 2-Proposed Action would result in a major reduction of erosion within the Project Area. The Forest Service's divides sediment erosion into two categories: 1) upland and adjacent riparian areas, which include factors such as borrow/fill, temporary and system roads, moving stream channels, and land cover, and 2) erosion from streambank and in-stream areas (USFS et.al 2014).

Implementation of the stream restoration work is anticipated to take place over a multi-year period. Table 3-5 provides the erosion estimates, except as noted, for a 10-year period.

Much of the proposed work under Alternative 2-Proposed Action would take place in the upland and riparian areas, and despite this high level of activity, only a modest increase (23 percent; 680 tons/decade) in soil erosion was predicted from upland and riparian areas throughout the Project Area compared to Alternative 1-No Action. As restoration revegetation matures over time, the level of erosion would also diminish; however, the moderate increase in upland and riparian erosion is greatly overshadowed by the reduced erosion within the Project Area's stream channels. As shown in Table 3-5, Alternative 2-Proposed Action is anticipated to result in an 86 percent reduction (84,040 tons/decade) of erosion within the Project Area. The greatest reduction by volume would be realized in the Clarks Creek watershed. Similar beneficial reductions were also noted with mean suspended sediment concentrations, which would lead to greatly improved water quality.

TABLE 3-5: ESTIMATED SEDIMENT PRODUCTION WITHIN THE PROJECT AREA

	Units	Clarks Creek	Little Turkey Creek	McCluney Branch	Unnamed Tributary to Clarks Creek	Total*
Streambank Erosion						
Alt. 1-No Action	Tons/Decade	38,270	23,150	17,160	12,270	90,850
Alt. 2-Proposed Action	Tons/Decade	2,310	1,350	650	840	5,150
	Percent Reduction	*94%*	*94%*	*96%*	*93%*	*94%*
Total Land and Streambank Erosion						
Alt. 1-No Action	Tons/Decade	41,400	25,910	17,560	13,120	98,000
Alt. 2-Proposed Action	Tons/Decade	6,110	4,540	1,340	1,980	13,970
	Percent Reduction	*85%*	*82%*	*92%*	*85%*	*86%*
Estimated Mean[1] Suspended Sediment Concentration						
Alt. 1-No Action	ppm/Decade	770	640	1,550	610	770
Alt. 2-Proposed Action	ppm/Decade	110	110	120	90	110
	Percent Reduction	*86%*	*83%*	*92%*	*85%*	*86%*
Annual Total Sediment, normalized by Stream Length						
Alt. 1-No Action	Tons/Foot/Year	0.109	0.105	0.114	0.075	0.102
Alt. 2-Proposed Action	Tons/Foot/Year	0.013	0.015	0.008	0.011	0.012
	Percent Reduction	*88%*	*86%*	*93%*	*85%*	*88%*

ppm = parts per million
*****Totals were rounded
[1] Weighted mean by watershed size

Implementing Alternative 2-Proposed Action would require clearing vegetation prior to grading. The amount of vegetation that would need to be cleared prior to construction would vary by approach. The P2-floodplain excavation approach would require clearing more vegetation than the other approaches given the wide floodplain that would need to be excavated. Because the P3-floodplain benches approach involves more specific site treatments (e.g., expanding the area flooded in alternating bends), it requires the least timber removal. Although some timber could be identified in advance for reuse during the construction of instream features, some timber has commercial value and would be sold following Forest Service procedures. Clearing would sometimes include stump removal. Some trees, root wads, and shrubs could be salvaged for use in the stream restoration; existing clumps of desirable native rooted material would be excavated for storage and later reuse. Salvaged vegetation could be stored in a temporary nursery area located within the Project Area or other nearby suitable locations.

3.2.5 *Connected Actions*

Construction within the Project Area may result in temporary and short-term adverse effects on soil erosion, soil movement, and sedimentation. Clearing vegetation, including timber harvesting, would be needed within the stream restoration footprint, along travel routes, and in staging areas. Soil disturbance in upland areas would occur for temporary construction roads, within soil borrow and soil disposal areas, and in staging areas for construction

equipment. In riparian areas, clearing vegetation and soil disturbance would be associated with temporary roads and access to work areas, crossing streams with temporary bridges, and equipment use in and around the existing and proposed stream channel locations. Soil disturbance, compaction, and rutting would occur in construction areas and along roads. The existing road system would be used to the extent possible but would require some reconstruction (applying gravel to existing road surfaces and frequent maintenance) to reduce impacts to soils; especially during periods of heavy truck use associated with any hauling of dirt from borrow and spoil areas, log skidding, and hauling and movement of heavy equipment. Road use could be restricted immediately after heavy rains to reduce rutting which would maintain the roads surface and reduce soil erosion. Soil borrow areas would be limited to those with soils appropriate to the design goal. Of the 663 acres initially identified as potential soil borrow/spoil areas, only a portion would be disturbed because sufficient areas have been selected to provide options that would limit haul distances from borrow and spoil to the Project site, thereby reducing impacts to soils and roads. Forest standards including the use of BMPs specific to the Forest Service, USACE, and SCDHEC Erosion and Sediment Control Standards would be employed to limit erosion and sedimentation resulting from construction, and to guide restoration and stabilization of soils following construction. Forest Plan standards would include use of rolling dips and various water diversions on temporary roads, soil ripping, grading, disking at log landings and equipment staging areas followed by revegetation with native and desirable non-native grasses and forbs. This would reduce erosion and compaction and allow vegetation to re-establish and grow. Aggregate surfacing material would be used on temporary roads and at landings and activity areas where needed to reduce rutting and erosion. Roads in riparian areas would use other materials, such as chunk wood, woody debris or mats to provide access and to limit rutting and erosion. Temporary roads would be closed and revegetated after restoration work is completed with the intent to return them to a vegetated condition.

Upland soil types within the analysis area are better suited for temporary road building. Proper location of roads would help reduce the risk of excessive rutting and erosion. Use of reverse-grades and temporary culverts would be used where practical to direct water off the road surface in small amounts before it reaches a stream channel.

Soil would be displaced and exposed during temporary road construction; however, measures designed to stabilize the road surface, such as adding aggregate surfacing by armoring the soil or limiting the distance and amount of concentrated flow by installing water diversion devices (e.g., dips, reverse grades, out slopes, leadoff ditches, and culverts) would reduce adverse effects. The detachment of soil particles and the distance they move would be reduced by limiting water concentration and movement on disturbed surfaces and fill materials.

Temporary roads could contribute to erosion and sediment in the short-term (up to 3 years), but effective erosion control measures would mitigate the effects on soil and water. Closing temporary roads after use would allow the soil building process to begin on the road surface. As soil develops, vegetation would begin to grow. This process allows closed roads to recover to a more natural state. In some instances, closed temporary roads could allow

infrequent access for monitoring or could be reopened and used to make repairs to the streams with limited disturbance and damage to the temporary road.

3.2.6 *Forest Plan Amendment for Soils*

A Project-specific Forest Plan amendment would be required for stream restoration activities. The changes are needed to accomplish the purpose and need as described in this Final EIS. Table 3-6 lists the current Forest Plan standard and the proposed changes.

TABLE 3-6: PROSPOSED CHANGES TO FOREST PLAN STANDARDS

Current Forest Plan Standards	Proposed Changes*
FW-6: Skidders will only be allowed within the channels at designated crossings.	Heavy equipment would be permitted in the ephemeral channels of Project streams.
FW-14: Trees and native vegetation on the stream bank should not be removed except at designated crossings.	Trees and other native vegetation would be removed to reshape stream banks, restore floodplains, fill in the old channel and remove legacy sediments from Project streams.
FW-38: To limit soil compaction, no mechanical equipment is used on plastic soil when the water table is within 12 inches of the surface, or when soil moisture exceeds the plastic limit. Soil moisture exceeds the plastic limit if the soil can be rolled to pencil size without breaking or crumbling.	Activities would be permitted on plastic soils during stream restoration activities in Project streams, temporary roads and in soil borrow and disposal areas.

*Note: Specific to this Project only

Effects of plan amendment changes are described in direct, indirect and cumulative effects of Alternative 2-Proposed Action. Soil impacts would be reduced by following Forest Plan standards including BMPs and site-specific mitigation measures. Specifically, riparian areas compacted and rutted by stream restoration activities would be ripped (a mechanical treatment that burrows into the soil to break up the compacted layer), disked, smoothed and seeded with appropriate native and desired non-native vegetation. Upland areas associated with temporary roads and soil borrow/disposal areas in addition to the mitigation measures stated above would be limed and fertilized. Planting native trees in upland areas would hasten the recovery of disturbed areas. These mitigation measures would improve soil productivity and provide for rapid establishment of vegetation which would reduce the potential for erosion and sedimentation from Project activities both in the short and long term.

3.2.7 *Cumulative Effects of Alternative 2-Proposed Action*

Analysis of cumulative effects considered Alternative 2-Proposed Action in conjunction with reasonably foreseeable, future activities related to the management of national forest system lands as well as on adjacent and upstream private lands. Management activities within the Project Area include agriculture, residential areas, road and trail maintenance, management of openings for wildlife benefits, periodic prescribed burning and associated fireline reconstruction, and timber harvest. Generally, these activities negatively affect streams and wetlands through increased stormwater runoff, erosion and sedimentation, and reduced water quality. However, to a great extent these effects have been minimized and mitigated by past treatments, BMPs and other standards employed by the Forest Service. Furthermore, as indicated previously, Alternative 2-Proposed Action will significantly off-set the cumulative effects of these other projects, as well as result in significant improvements to the streams and wetlands within the Project Area. Specifically, Alternative 2-Proposed Action is estimated to reduce the cumulative effect of erosion from lands and streams within the Project Area at nearly 84,040 tons of sediment per decade, and to reduce mean suspended sediment concentrations by approximately 660 ppm over the same period (USFS et.al. 2014).

Stream restoration would also provide functional lift to hydraulic and geomorphology functions. The ability of the streams to transport both water and sediment loads would be greatly improved. This would lead to enhanced stream stability, improved diversity of streambed substrate and instream habitat features, reconnection to floodplains, restoration of riparian and wetland vegetation within the stream corridors, and improved nutrient management and water quality.

3.3 WATER, RIPARIAN AREAS, WETLANDS, FLOODPLAINS

3.3.1 *Affected Environment*

3.3.1.1 Climate and Watershed Response

South Carolina, and more specifically, the region surrounding the Project Area has a relatively mild climate. The average annual temperature is 60.4 degrees Fahrenheit (F), as reported at the nearby CHESTER 1 SE station (SCSCO 2014). Precipitation is characteristic of the region; the Lockhart hydroelectric station receives, on average, 43.5 inches of rainfall per year (SCSCO 2014). During the year, rainfall averages between 3 and 4.5 inches per month; the least rainfall occurs in April and May, and the greatest in March and August. Snow is a minor component of precipitation in the area, and it seldom accumulates in substantial amounts. Estimates of water yield are about 17 inches per year (Cooney et. al. 2003 as referenced in Hansen and Law 2004).

Hydrologic response to precipitation within a watershed is largely a function of the underlying geology, soils, and topography (Section 3.2). In addition, watershed runoff volumes are partly influenced by hydrologic conditions within the soil (i.e., landscape position, slope, storage capacity). These conditions are often characterized using NRCS soil data, in which NRCS categorizes soil map units into one of four hydrologic soil groups, A, B, C, or D, based on the propensity of the unit to generate runoff (NRCS 2009 as cited in Atkins

2014a). Soils in group A have the lowest runoff potential, while those in group D have the highest.

Most soils in the Clarks Creek, McCluney Branch, unnamed tributary to Clarks Creek, and the watersheds fall into hydrologic soil group C, meaning that the soils have moderately high runoff potential (Atkins 2014a). The Little Turkey Creek watershed mostly consists of group B soils, which have moderately low runoff potential. McCluney Branch has the largest component of group C soils. According to their hydrologic soil groups, Little Turkey Creek watershed should generate the least amount of runoff per unit area and McCluney Branch should generate the most runoff per unit area.

Watershed response to precipitation is affected further by annual and seasonal variation in storms and soil moisture is affected by transpiration rates of vegetation. Stream and precipitation gauges were installed within the Project Area during 2012 and 2013 (Atkins 2014a). During summer and fall 2012, for example, stream discharge was near zero in all watersheds, except during a period of heavy precipitation in August. Several smaller rain storms (each on the order of 0.50 to 0.75 inches) that occurred in the late summer and fall did not register an increase in stream discharge, likely due to a depletion of the soil moisture by the vegetation. Conversely, the watersheds appeared to be more responsive to rainfall during the winter and spring of 2013, when precipitation occurred more frequently and with the wetter antecedent conditions, increases in discharge were registered for smaller precipitation events.

The Forest Service developed a Nationwide guidance document for the assessment and improvement of watershed conditions in *Watershed Condition Framework and Classification Technical Guide* (USDA Forest Service 2011a, 2011b), referred to here as the watershed condition framework. The application of this guidance continues to be refined as implemented, but represents another step to further recognize the importance of water to not only national forest resources, but also the needs for the economic and public benefit of water in development and growth. The framework provides a rating system to compare the relative health and function of watershed condition, over time, by using a variety of physical, chemical, biological and operational indicators. Consistent with new national guidance, procedures to assess watershed condition were implemented in 2011 by an integrated team of personnel from Francis Marion and Sumter National Forests. The Project Area is located within the Hughes Creek-Broad River subwatershed (referred to as Hughes Creek), and the Forest Service's initial analysis of various indicators and attributes show that the area has an overall poor rating (class 3); the Forest Service is in the process of completing the full, site-specific watershed assessment for Hughes Creek subwatershed consistent with Forest Plan direction and the watershed condition framework. This initial analysis suggests that the Hughes Creek subwatershed is not functioning sufficiently to provide geomorphic, hydrologic, and biotic integrity relative to their natural potential (USDA Forest Service 2011c).

The 2011 "poor condition" rating of the Hughes Creek subwatershed, which contains the Project Area, was based on watershed indicators such as water quality, aquatic habitat and riparian vegetation, along with road density, road maintenance, soil productivity and soil

erosion. Most of the other factors considered in the analysis were in fair condition and indicative of a functioning at risk status, and included parameters such as water quantity, aquatic species, NNIS and forest health (e.g., insects and disease and ozone). A few factors that received a good rating included no mass wasting associated with roads, no soil contamination, and an acceptable and functioning fire condition class and associated vegetation.

STREAMS, WETLANDS, AND FLOODPLAINS

For jurisdictional determination purposes, streams and wetlands were inventoried within Study Area 1 (as described in Section 3.1) of the Project Area (Atkins 2014a). These delineations identified 100 jurisdictional streams and 10 jurisdictional wetlands. Approximately 111,534 linear feet of stream and 4.47 acres of wetlands were delineated within Study Area 1 (Table 3-7, Figure 3-12 through Figure 3-15). Following Cowardin et al. (1979 as cited in Atkins 2014a), these streams were classified as predominantly 1) riverine, intermittent, streambed, or 2) riverine, upper perennial, unconsolidated bottom; whereas, wetlands are classified as either 1) palustrine, forested, broad-leaved, deciduous, or 2) palustrine, forested, broad leaved/needle-leaved, deciduous (Atkins 2014a). Approximately 24 acres of floodplain were identified (FEMA 2013 as cited in Atkins 2014a).

TABLE 3-7: PRELIMINARY JURISDICTIONAL AREA FEATURES LOCATED IN STUDY AREA 1

Watershed	**Stream** (Linear Feet)	**Wetlands** (Acres)
McCluney Branch	18,147	0.04
Little Turkey Creek	31,543	0.03
Clarks Creek	42,569	0.98
UT to Clarks Creek	19,275	3.42
Total	111,534	4.47

Note 1: Jurisdictional area features are preliminary and subject to change after USACE jurisdictional determination.
Note 2: UT – Unnamed tributary

The larger wetlands are located near confluences with the Broad River, while the smaller, isolated wetlands are distributed across the Project Area and differ in proximity, hydrology, and function. All wetlands are closely tied to their adjacent streams within the four Study Area 1 watersheds. The identified wetlands are considered to provide high functional benefit because the interaction of streams and wetlands provide synergistic functions, including flood attenuation, wildlife habitat, nutrient and sediment retention, and baseflow regulation. However, Atkins (2014a) notes that far fewer wetlands are located in headwater and stream-side areas than would be expected in forested areas of this ecoregion, which is largely due to depressed water tables and incised stream channels.

McCluney Branch Watershed

Streams

McCluney Branch watershed covers 605 acres, of which 22 percent falls within Study Area 1 (Figure 3-12). This watershed contains the McCluney Branch mainstem and 22 unnamed tributaries, for a total of 18,147 linear feet of stream (Table 3-7; Figure 3-12). The headwaters of McCluney Branch originate north of Worthys Ferry Road and south of Feltman Road.

Wetlands

McCluney Branch watershed contains one jurisdictional wetland totaling 0.04 acres (Table 3-7; Figure 3-12). It is considered to be a relatively permanent water of the United States and is a palustrine, forested wetland.

Little Turkey Creek Watershed

Streams

Little Turkey Creek watershed covers 2,264 acres, of which 15 percent falls within Study Area 1 (Figure 3-13). This watershed contains Little Turkey Creek mainstem and 27 unnamed tributaries, for a total of 31,543 linear feet of stream (Table 3-7; Figure 3-13). The headwaters of Little Turkey Creek originate near the intersection of Worthys Ferry Road and Woods Ferry Road.

Wetlands

Little Turkey Creek watershed contains two jurisdictional wetlands totaling 0.03 acres (Table 3-7; Figure 3-13). The wetlands are considered relatively permanent waters of the United States and are palustrine, forested wetland.

Clarks Creek Watershed

Streams

Clarks Creek watershed covers 2,838 acres, of which 18 percent falls within Study Area 1 (Figure 3-14). This watershed contains Clarks Creek mainstem and 30 unnamed tributaries, for a total of 42,569 linear feet of stream (Table 3-7; Figure 3-14). The headwaters of Clarks Creek originate southwest of the intersection of Bucks Grave Road and Woods Ferry Road.

Wetlands

Clarks Creek watershed contains four jurisdictional wetlands totaling 0.98 acres (Table 3-7; Figure 3-14). The wetlands are considered relatively permanent waters of the United States and are palustrine, forested wetland.

Unnamed Tributary to Clarks Creek Watershed

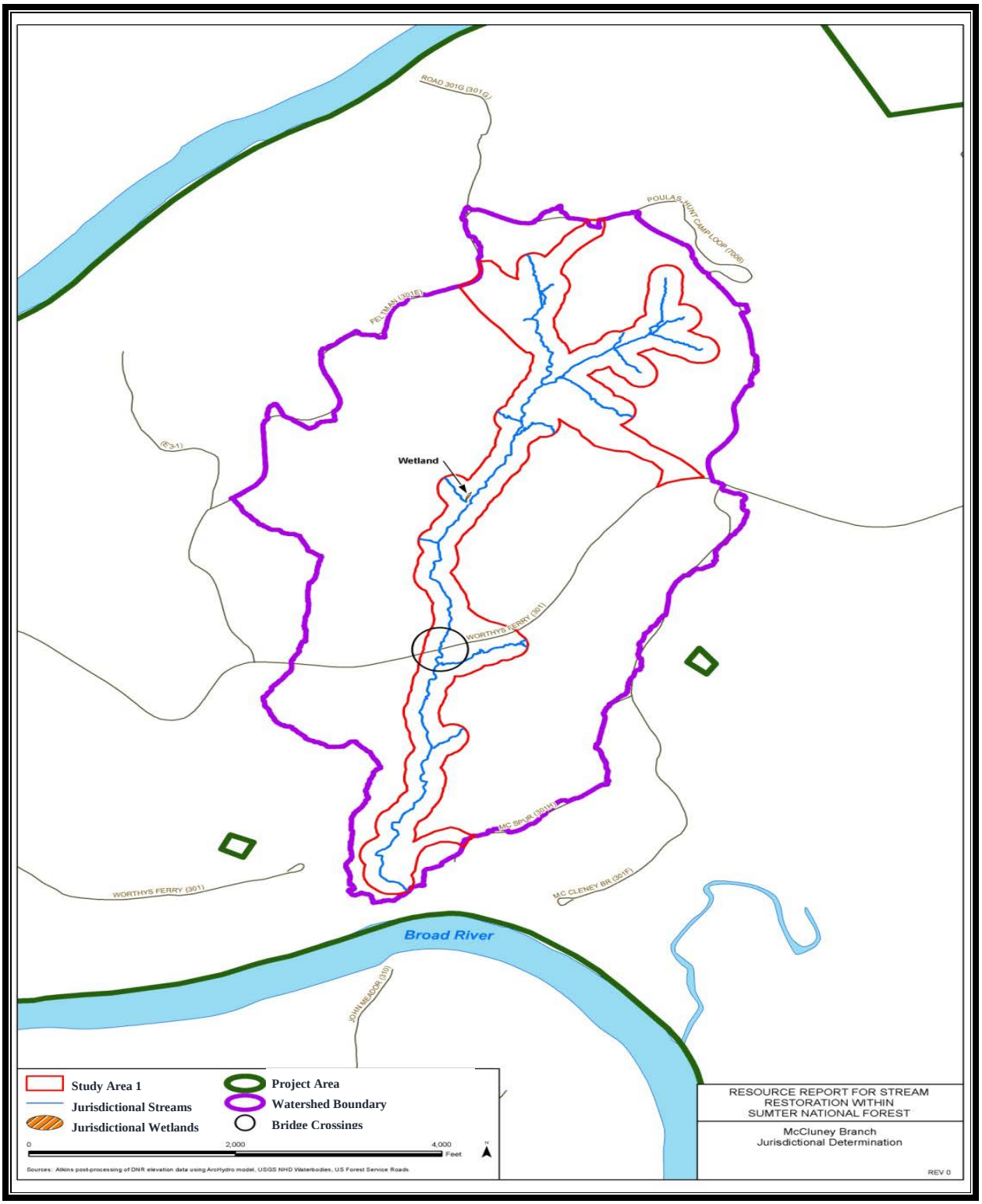
Streams

Unnamed tributary to Clarks Creek watershed covers 1,141 acres, of which 23 percent falls within Study Area 1 (Figure 3-15). This watershed contains the unnamed mainstem and 13

smaller, unnamed tributaries, for a total of 19,275 linear feet of stream (Table 3-7; Figure 3-15). The unnamed tributary to Clarks Creek joins Clarks Creek just before entering the Broad River. The headwaters of the unnamed tributary to Clarks Creek originate due west of the intersection of Bucks Grave Road and Woods Ferry Road.

Wetlands

Unnamed tributary to Clarks Creek watershed contains three jurisdictional wetlands totaling 3.42 acres (Table 3-7; Figure 3-15). The wetlands are considered relatively permanent waters of the United States and are palustrine, forested wetland.



Source: Atkins 2014a

Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

FIGURE 3-12: PRELIMINARY JURISDICTIONAL STREAMS AND WETLANDS WITHIN THE MCCLUNEY BRANCH WATERSHED

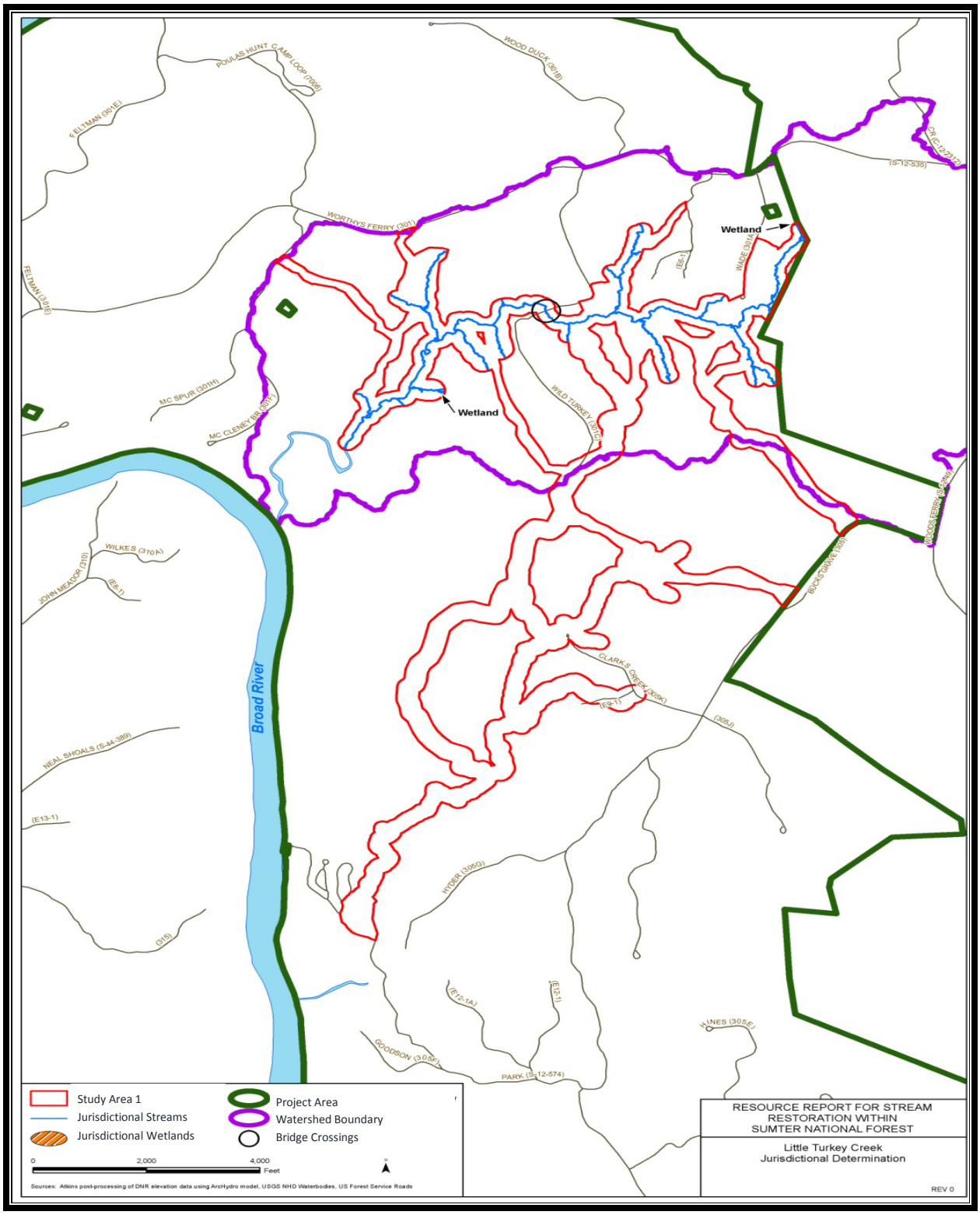


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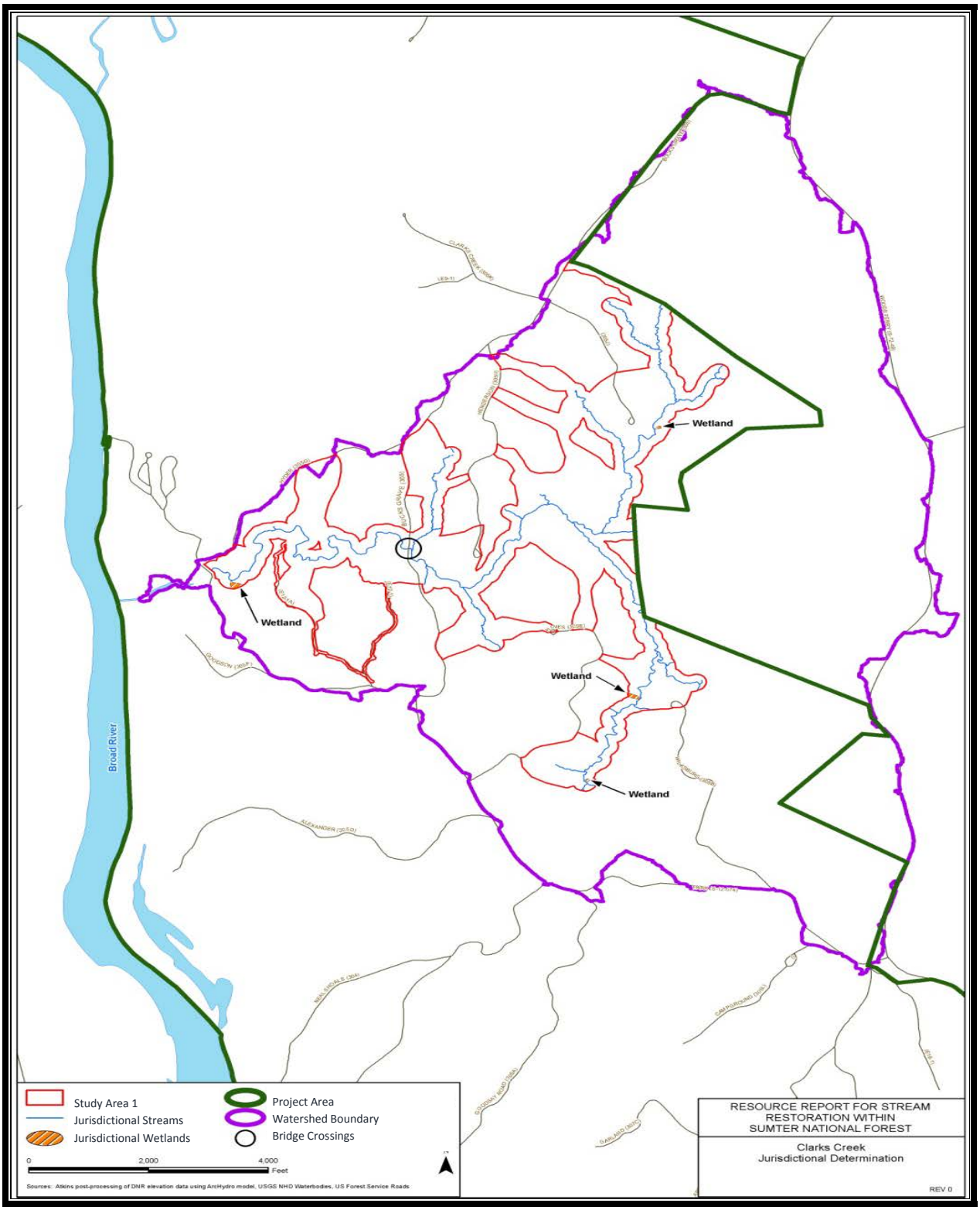
FIGURE 3-13: PRELIMINARY JURISDICTIONAL STREAMS AND WETLANDS WITHIN THE LITTLE TURKEY CREEK WATERSHED



Source: Atkins 2014a

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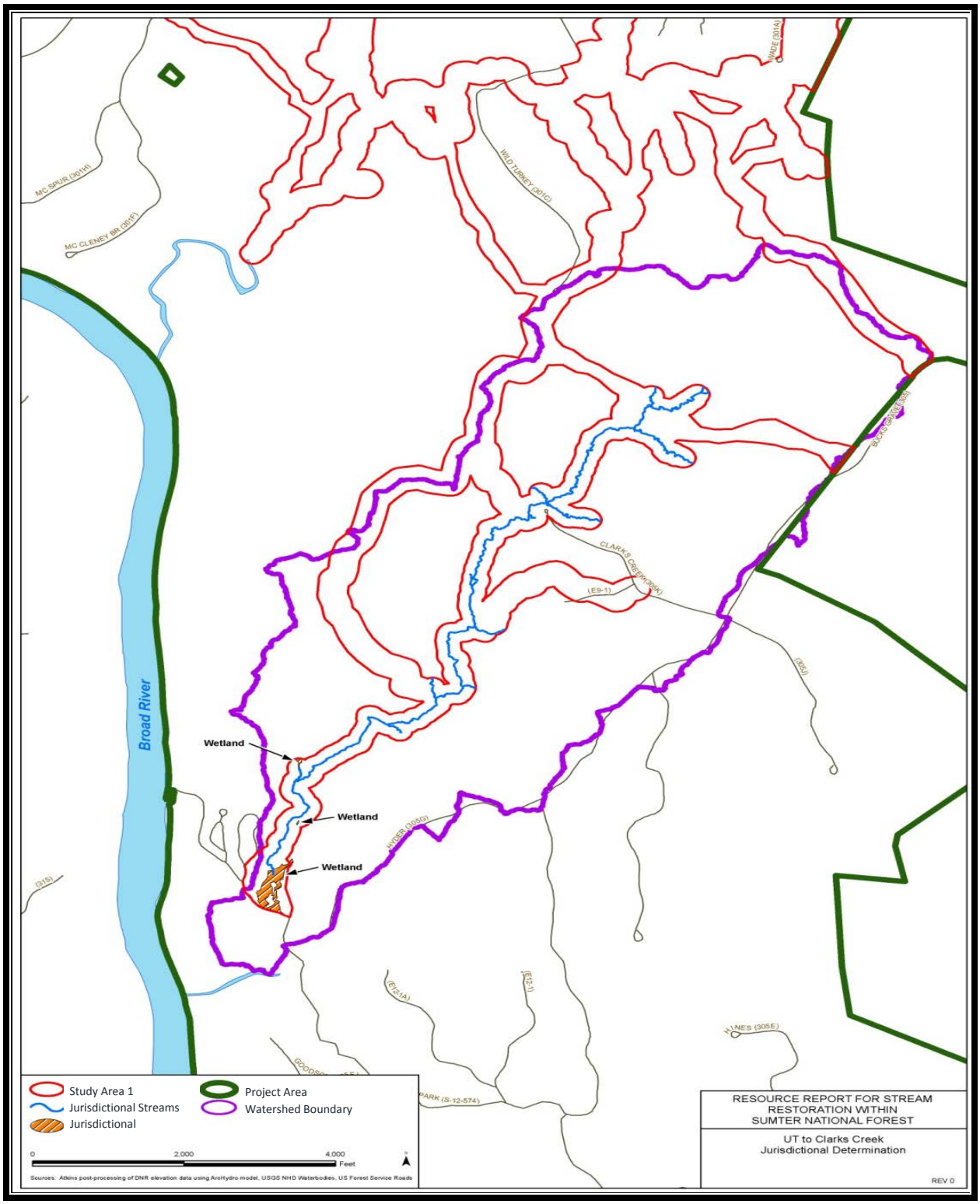
FIGURE 3-14: PRELIMINARY JURISDICTIONAL STREAMS AND WETLANDS WITHIN THE CLARKS CREEK WATERSHED



Source: Atkins 2014a

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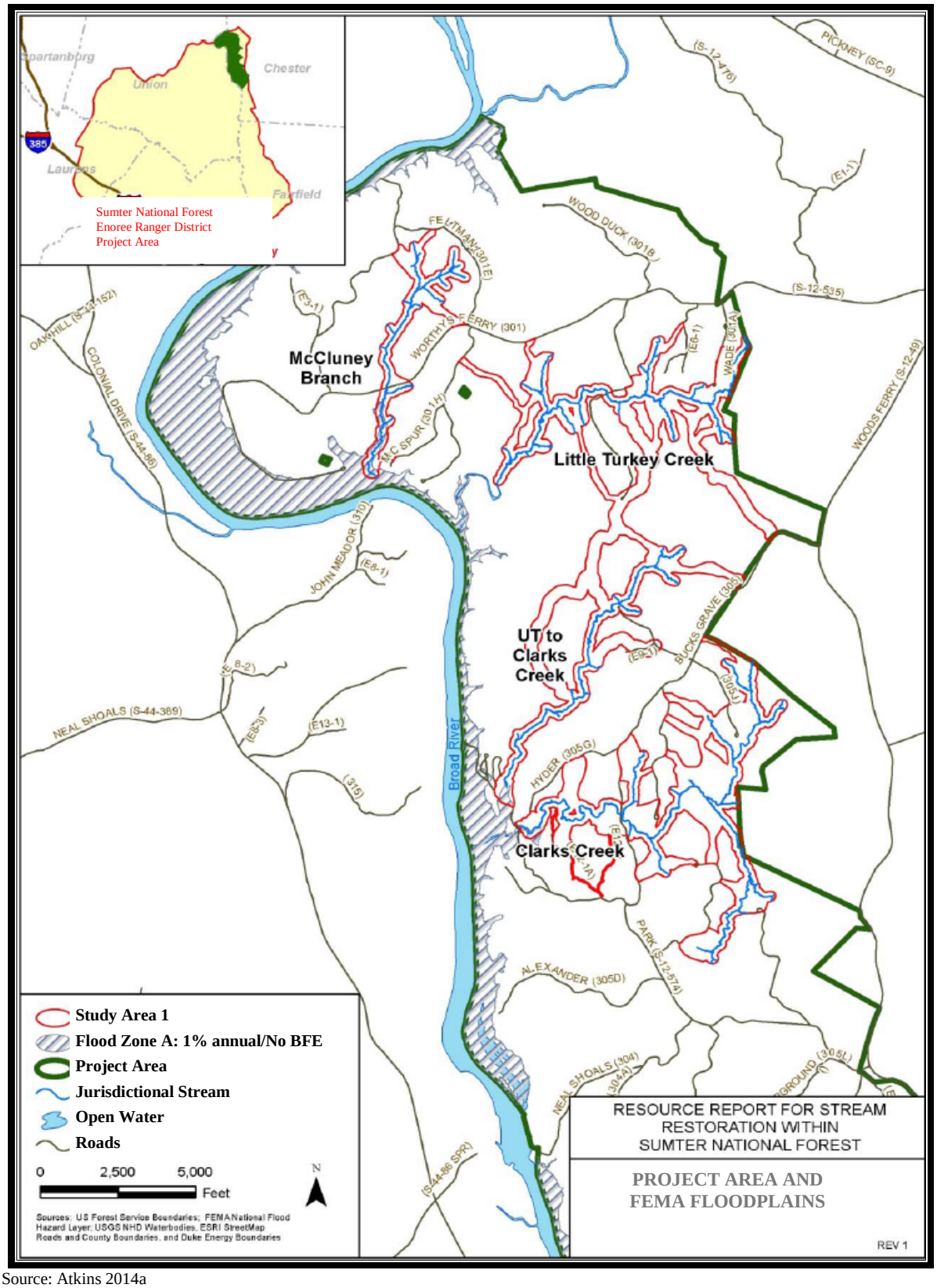
FIGURE 3-15: PRELIMINARY JURISDICTIONAL STREAMS AND WETLANDS WITHIN THE UNNAMED TRIBUTARY TO CLARKS CREEK

3.3.1.2 Floodplains

The Federal Emergency Management Agency (FEMA) mapping for special flood hazard areas (SFHA) in the Project Area indicates Zone A areas in lower elevations along, and associated with flooding from, the Broad River. The Zone A designation corresponds to areas subject to inundation by the 1-percent-annual-chance flood (100-year storm), but for which no base-flood elevations have been determined (USDHS FEMA 2013 as cited in Atkins 2014a). The Project Area encompasses 2,203 acres of Zone A floodplain, of which approximately 24 acres are located within Study Area 1 near the mouth of each watershed (Figure 3-16).

Hydraulic modeling for a portion of Clarks Creek indicated that waters from the 100-year storm were largely contained within the stream channels (Atkins 2014a). These results contrast sharply to a properly functioning stream, which would be expected to overtop its banks and access its floodplain for events with a return interval greater than 1.5 years. The extreme degree of stream incision, and the attendant lack of access to the historic floodplain or the existing terrace surface in the valley bottom, causes the stream channel itself to bear the force of high flow events without the relief provided by overbank flow, further destabilizing the stream and causing more incision and/or bank widening. The results of the preliminary hydraulic analysis can be extrapolated to other streams within Study Area 1 with similar bank height ratios and, therefore, levels of stream incision. Furthermore, disconnection with the historic floodplain influences vegetative communities (Section 3.7), as species composition shifts over time in response to changes in watershed hydrology.



Source: Atkins 2014a

Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

FIGURE 3-16: DESIGNATED FEDERAL EMERGENCY MANAGEMENT AGENCY FLOODPLAINS THROUGHOUT THE PROJECT AREA

3.3.1.3 Streams

Streams within Study Area 1 were characterized and evaluated using fluvial geomorphic principles of the Rosgen classification system (Rosgen 1996 as cited in Atkins 2014a) to describe their condition and to support stream restoration design (Atkins 2014a). This classification system stratifies and describes various stream types based on dimension, pattern, profile, and substrate characteristics. Primary components of the classification scheme include entrenchment ratio, width/depth ratio, sinuosity, channel slope, and substrate composition. Based on these values, a stream type denoted by the letters A through G is determined, and a modifier, a number between 1 and 6, is used to denote a substrate ranging in size from bedrock to silt/clay.

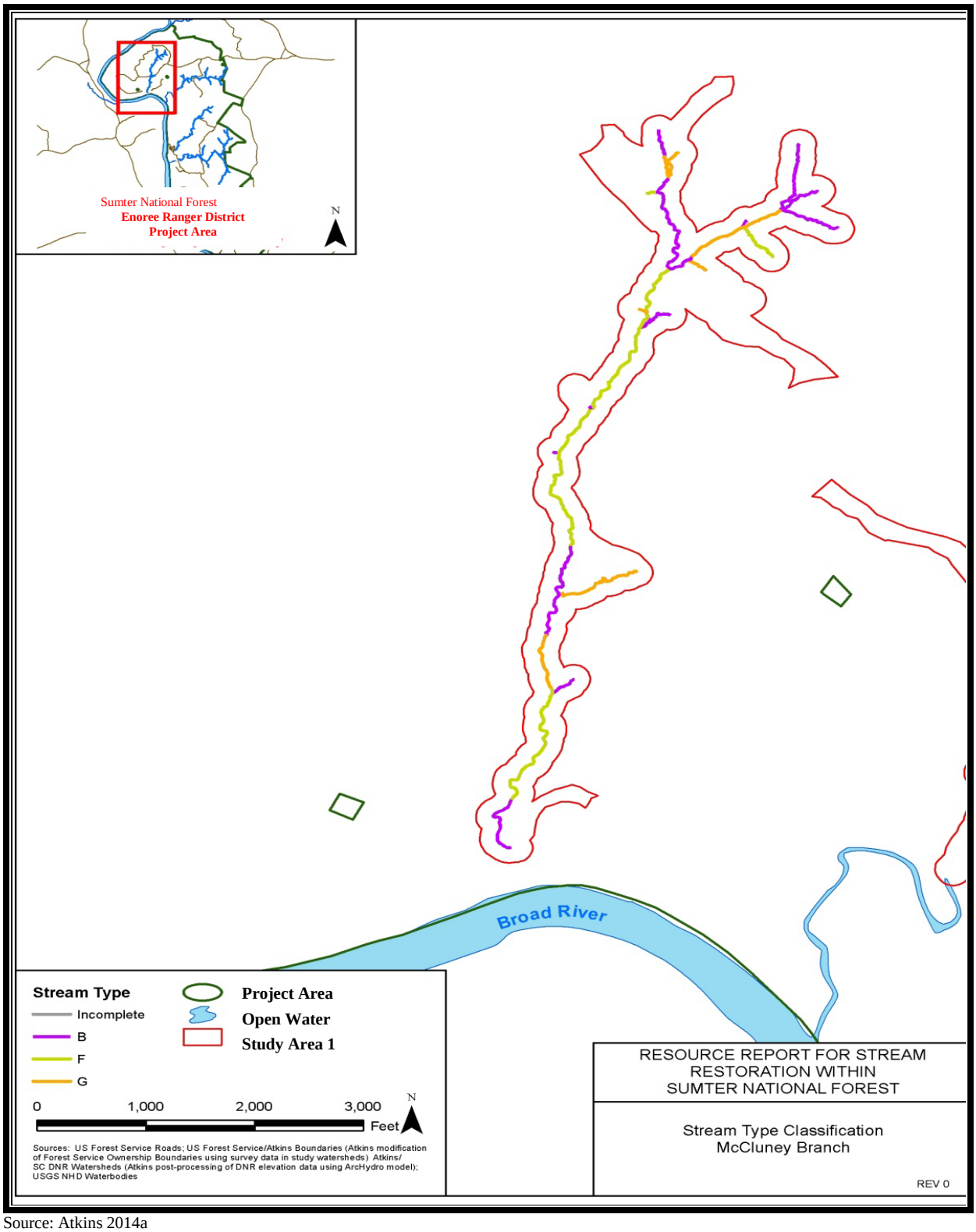
Most streams within Study Area 1 have been described using the Rosgen fluvial geomorphic classification system (Atkins 2014a). Inventories are in progress for the remaining streams, and missing data are indicated hereafter as incomplete. Streams were divided into discrete classification reaches as dictated by the predominant stream type. Due to history of this area with gullying, valley filing and channel modifications, the current channels do not represent reference conditions.

Based on field-surveyed measurements, the predominant stream types identified in the Study Area 1 streams are B, F, and G type channels (Figure 3-17 through Figure 3-20). Table 3-8 summarizes the general characteristics of these stream types (Atkins 2014a). The Study Area 1 mainstem streams are predominantly F and B stream types with isolated G type channels. A large proportion of smaller tributaries are B type channels. Table 3-9 provides the length (i.e., surveyed thalweg stationing length) and percentage of stream type for each watershed and for the combined Study Area 1 reaches.

TABLE 3-8: GENERAL CHARACTERISTICS OF STREAM TYPES IDENTIFIED WITHIN STUDY AREA 1

Stream	General Characteristics
B	Moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools. Very stable plan and profile. Stable banks.
F	Entrenched, meandering riffle/pool channel on low gradients with wide, shallow channels.
G	Entrenched “gully” with narrow widths on moderate gradients.
E	Not entrenched. Low gradient, meandering riffle/pool stream with narrow widths and little deposition. Very efficient sediment transport, stable. Very sinuous.

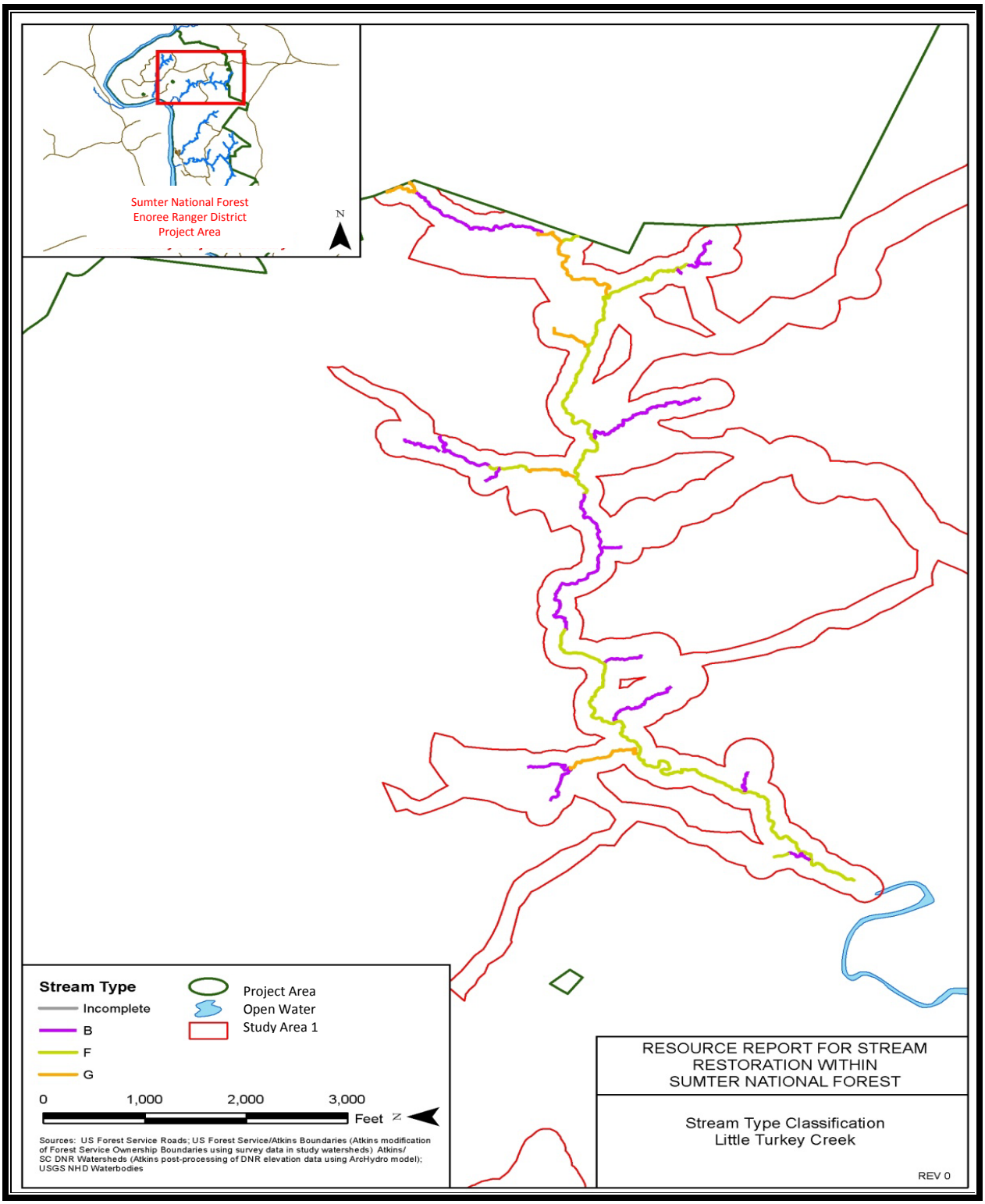
Source: Rosgen 1996



Source: Atkins 2014a

Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

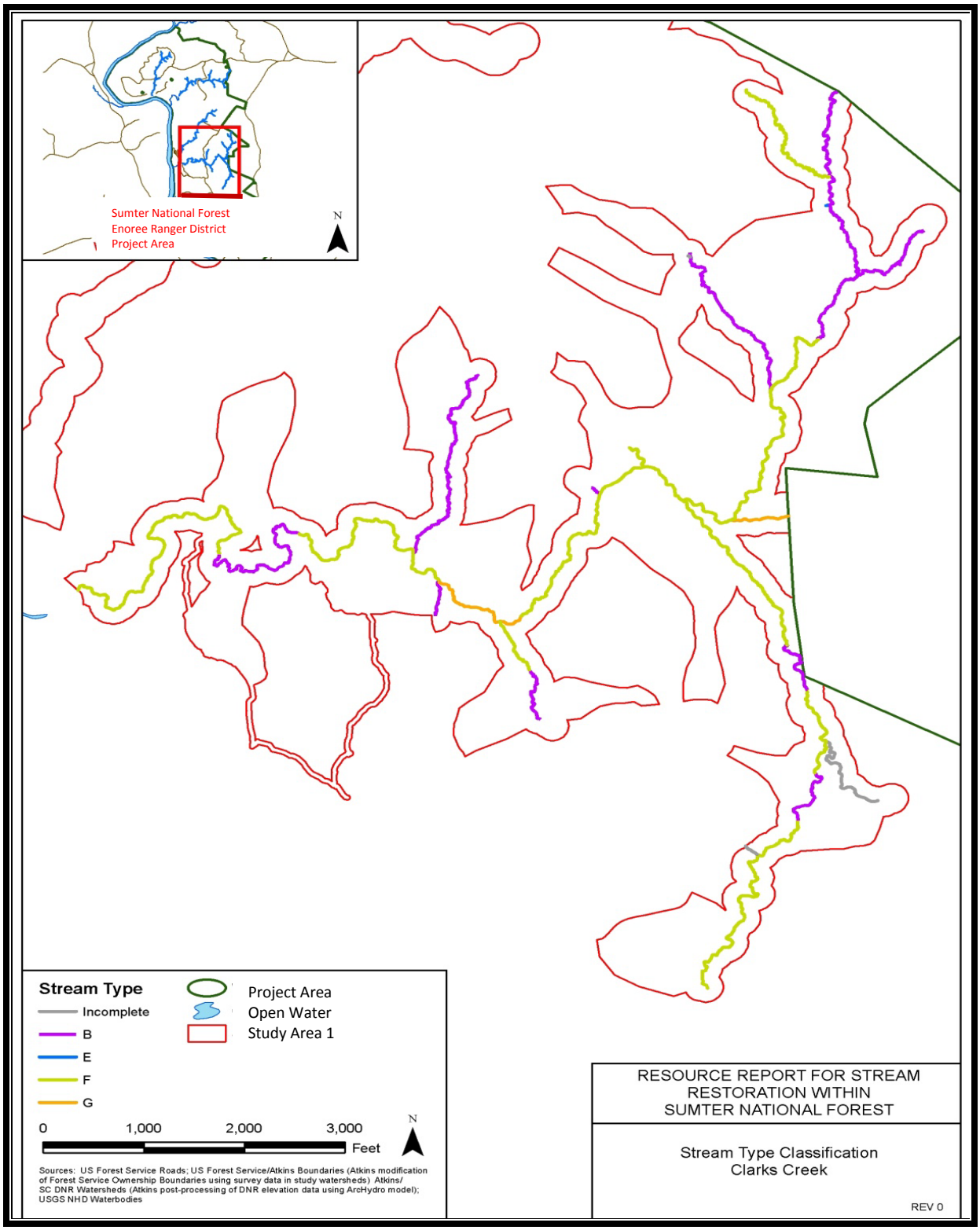
FIGURE 3-17: STREAM TYPE CLASSIFICATION FOR MCCLUNEY BRANCH



Source: Atkins 2014a

Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

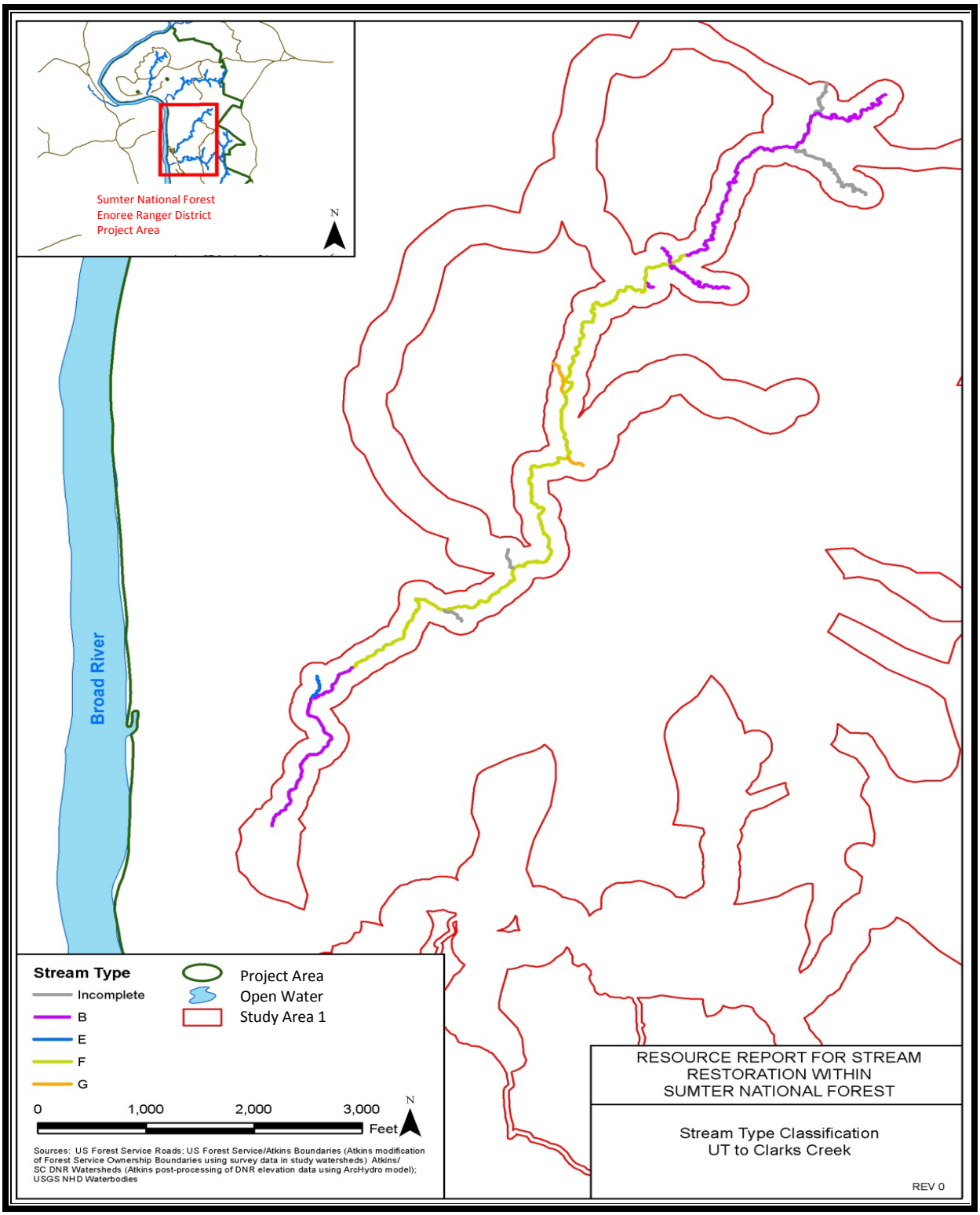
FIGURE 3-18: STREAM TYPE CLASSIFICATION FOR LITTLE TURKEY CREEK



Source: Atkins 2014a

Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

FIGURE 3-19: STREAM TYPE CLASSIFICATION FOR CLARKS CREEK



Source: Atkins 2014a

Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

FIGURE 3-20: STREAM TYPE CLASSIFICATION FOR UNNAMED TRIBUTARY TO CLARKS CREEK

TABLE 3-9: STREAM CLASSIFICATION TYPE BY WATERSHED WITHIN STUDY AREA 1

Watershed	Stream Length, in Feet, and Percent of Stream Type by Watershed[3]					Total Length[1],[4]
	B type	F type	G type	E type	Incomplete[2]	
McCluney Branch	3,507	5,475	869	-	5,794	15,645
	22%	35%	6%	--	37%	100%
Little Turkey Creek	10,545	10,552	4,062	-	221	25,379
	42%	42%	16%	--	less than 1 %	100%
Clarks Creek	14,655	22,546	1,794	43	1,502	40,541
	36%	56%	4%	less than 1 %	4%	100%
UT to Clarks Creek	7,368	7,857	562	259	2,185	18,231
	40%	43%	3%	1%	12%	100%
Total Length and Percent by Type[4]	36,076	46,429	7,288	302	9,702	99,796
	36%	47%	7%	less than 1 %	10%	

Note: UT – unnamed tributary
1 The stream length for stream type classification was calculated using the surveyed thalweg stationing. This does not match length for USACE purposes of jurisdiction or restoration planning.
2 Data not available at the time of publication (Atkins 2014a). Stream reaches with incomplete classification are shown on Figure 3-18 through Figure 3-20.
3 Not all jurisdictional streams were evaluated for stream classification. Only reaches considered to be restorable were evaluated.
4 The sum of individual items may not equal totals due to rounding.

Dominant particle sizes of streambed substrate within the Study Area 1 were either sand or gravel (Atkins 2014a). The gravel substrate materials are primarily angular and likely stem from the degradation of exposed bedrock sills and/or erosion through streambank and channel bottom sediments to residual parent material soils or to bedrock. In general, mainstem channels were classified as sand bed channels with occasional coarse riffles attributed to locations where bedrock and boulder sills have been exposed during channel degradation (Section 3.2). In mainstem headwaters and tributaries, channel substrates tended to coarsen, as riffles containing gravel or, occasionally, a larger cobble substrate, were more common. Bedrock was also observed in both mainstems and tributaries across all four watersheds. Table 3-10 summarizes channel substrate by stream type and watershed. Approximately 38 percent of the assessed stream channel lengths within Study Area 1 were classified as sand channels and 55 percent as gravel channels. An additional evaluation of channel substrate as aquatic habitat was performed separately (Atkins 2014b).

TABLE 3-10: CHANNEL SUBSTRATE BY STREAM TYPE FOR THE FOUR STUDY AREA 1 WATERSHEDS

			Percent of Total Length by Substrate and Channel Type					
Watershed	**Total Length (LF)[1]**	**Substrate**	**B type**	**F type**	**G type**	**E type**	**Unavailable**	**Total**
McCluney Branch	15,645	sand	7	12	6	0	37	
		gravel	16	23	0	0		
		Total	**22**	**35**	**6**	**0**	**37**	100.0
Little Turkey Creek	25,379	sand	32	38	4	3	9	
		gravel	0	7	7	0		
		Total	**32**	**45**	**11**	**3**	**9**	100.0
Clarks Creek	40,541	sand	24	47	4	0	4	
		gravel	13	9	0	0		
		Total	**36**	**56**	**4**	**0**	**4**	100.0
UT to Clarks Creek	18,231	sand	28	0	11	0	14	
		gravel	29	15	2	0		
		Total	**57**	**15**	**13**	**0**	**14**	100.0

Note 1: The sum of individual items may not equal totals due to rounding.
Note 2: UT- unnamed tributary
[1] The stream length was calculated using the surveyed thalweg stationing.

3.3.1.4 Water Quality

The state assigned the Broad River (at SC 72/215/121) a usage classification of Class FW-Freshwaters (SCDHEC 2008 as cited in Atkins 2014a). The four watersheds within Study Area 1 are also classified as Class FW. This designation indicates that these waters are "suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment." They are also "suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora as well as suitable for industrial and agricultural uses" (SCDHEC 2008 as cited in Atkins 2014a). Clarks Creek is the only candidate stream for which the SCDHEC collected water quality data, and it has been designated as non-supporting of recreational use due to fecal coliform bacteria (SCDHEC 2007 as cited in Atkins 2014a). The source of fecal coliform bacteria is unknown, but is most likely a combination of land application of livestock waste, failing on-site wastewater disposal systems, cattle in streams, and wildlife (SCDHEC 2005 as cited in Atkins 2014a). Clarks Creek is not on the Section 303(d) impaired waters list for fecal coliform bacteria because a TMDL for the pollutant has not been developed and approved. Little Turkey Creek, McCluney Branch, and the unnamed tributary to Clarks Creek, have not been assessed for the Section 303(d) list (SCDHEC 2010 as cited in Atkins 2014a).

Monthly water quality samples were collected at 7 stream flow gauge locations within Study Area 1 from February 2012 through August 2013 (Atkins 2014a). Results from baseflow monitoring indicate that existing surface water conditions generally meet SCDHEC water classifications and standards (Table 3-11). The main exceptions were 3 individual exceedances of the turbidity standard at 3 sites and 2 exceedances of the pH standard at 2 sites. Given that such a low percentage of samples at each location showed elevated levels,

the exceedances probably are not representative of the overall nature of the Project streams under base flow conditions; however, concentrations of suspended water quality constituents could be elevated during rain events.

TABLE 3-11: WATER QUALITY AT STATIONS THROUGHOUT STUDY AREA 1 OF THE PROJECT AREA FROM FEBRUARY 2012 TO AUGUST 2013

Parameter Sampled	Project Area Mean	Project Area Minimum	Project Area Maximum	Project Area Number of Samples	SCDHEC Minimum Standard	SCDHEC Maximum Standard
Temperature (°C)	16.7	5.8	25.9	119	NA	32.2
Dissolved Oxygen (%)	87.1	12.8	133.9	119	NA	NA
Dissolved Oxygen (mg/L)	8.92	4.02	13.70	112	4.00	NA
Conductivity (µS/cm)	111	45	884	119	150[2]	500[2]
pH	6.9	5.81[1]	7.6	119	6.0	8.5
Turbidity (NTU)	16.7	1.4	69.01[1]	118	NA	≤50.0
Total Kjeldahl Nitrogen (mg/L)	0.51	<0.50	1.40	118	NA	NA
Nitrate (mg/L)	0.03	<0.02	0.10	118	NA	NA
Nitrite (mg/L)	0.02	<0.02	0.02	118	NA	NA
Nitrate+ Nitrite (mg/L)	0.03	<0.02	0.10	118	NA	10.00**
Total Nitrogen* (mg/L)	0.07	<0.02	1.07	118	NA	NA
Total Phosphorus (mg/L)	0.09	<0.05	0.39	118	NA	NA

Note: Laboratory sample results were not available for CNF West (HW1) in November 2012.
[1] Shaded entries indicate parameters with values outside of the suggested range.
[2] No SCDHEC standard; levels reflect U.S. Environmental Protection Agency guidelines.
*Total Nitrogen reported as the calculated sum of Total Kjeldahl Nitrogen, Nitrate and Nitrite.
**Reflects Maximum Contaminant Level for South Carolina.

3.3.2 *Direct and Indirect Effects of Alternative 1-No Action*

Streams within the Project Area have degraded hydraulic, geomorphologic, and physicochemical functions (Figure 2-1, Harman, et al. 2012). The degraded stream conditions (e.g., increased bank migration rates, reduced lateral stability, accelerated channel evolution, increased sediment transport competency and capacity, reduced bed form diversity, relatively uniform bed material) are indicators that the geomorphologic function has been negatively affected, compared to a reference stream. Under Alternative 1-No Action the geomorphologic function of streams within the Project Area would continue to be severely degraded. Although natural evolution of the stream channel eventually could result in improved channel stability, such change is unlikely in a reasonably foreseeable timeframe (e.g., decades).

Hydraulic function has been severely degraded by the widespread channel incision observed throughout the Project Area, which negatively affects floodplain connectivity, flow dynamics and associated interactions between groundwater and surface water interactions. Under Alternative 1-No Action, riparian areas are expected to remain functioning at risk due to loss in floodplain connectivity and water table in a similar condition.

Geomorphology of the stream systems will continue to degrade as the system struggles to transport and temporarily store within its banks the excessive sediment load, estimated at nearly 98,000 tons per decade (Table 3-5). As indicated by estimates of mean suspended sediment concentrations (770 ppm) over a ten year period, water quality would continue to be negatively affected under Alternative 1-No Action.

3.3.3 *Cumulative Effects of Alternative 1-No Action*

Alternative 1-No Action does not propose any new ground disturbance. Effects to soils generally occur because of ground disturbing activities. However, soil erosion within the stream channels would continue at the accelerated rate noted above, resulting in sediment accumulation in downstream areas. Beyond the stream channel, cumulative effects from past and present activities generally result in a localized loss in soil productivity due to sheet erosion associated with the loss of the A horizon and much of the B horizon over much of the area and locally gully erosion which has eroded into C horizon saprolite layer of extremely erosive, weathered bedrock materials, as well as compaction, rutting, and/or soil displacement. Reasonably foreseeable activities on national forest system lands in the Project Area include timber harvesting, prescribed burning, wildlife habitat improvements and management activities, trail construction and maintenance, herbicide control of non-desirable species (including NNIS), road maintenance (i.e., culvert repair and replacement), Georgia aster treatments, and erosion control practices. These activities would be implemented under the standards for protecting soils listed in the Forest Plan (2004a); therefore, cumulative effects from these actions are minimal. Soil erosion estimates for Forest Service activities within the Project Area are approximately 7,140 tons over the next decade. Activities on private lands will be site specific to those lands and no cumulative effects would occur to the soil resource from those actions.

The Hughes Creek subwatershed assessment has identified projects that when included with other proposed or future projects can lead to an overall improvement in watershed condition. Under Alternative 1-No Action, projects identified by the subwatershed assessment effort

would be implemented individually or as part of a larger environmental analysis/watershed improvement strategy.

3.3.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

Implementing the landscape-scale stream restoration described in Alternative 2-Proposed Action would result in considerable, functional lift for both hydraulic and geomorphologic function throughout the Project Area by restoring stream channels that are stable and are able to move water and sediment without degrading or aggrading and that are reconnected to riparian and floodplain areas (e.g., restoration would reduce streambank sediment production by approximately 84,040 tons over the first ten years). Reconnection to the floodplain would alleviate erosion related to the incised condition of the channels, which currently puts undue pressure on the stream banks and beds during flood flows. The stream forms would have more diverse kinds of beds and substrates. The streams would be more resilient and sustainable; some instream and grade control structures would be installed to prevent failure due to natural channel shifting that may occur over time after restoration. Even under restored conditions, the expected low rates of sediment production would continue to decline, eventually approaching natural rates as areas further stabilize with the full establishment and expansion of native trees, other vegetation and their root systems.

Improving these lower-level functions probably would lead to improvement of higher-level physicochemical function (e.g., instream temperatures, nutrient cycling, and carbon storage) and biological function (e.g., greater species richness and abundance, fewer tolerant organisms, supporting all life histories,). In fact, the mean suspended sediment concentration across all watersheds would benefit by an 88 percent reduction (Table 3-4) expected over a decade with treatment. Additional sediment reductions may occur with some mitigation measures, although there is the potential for greater sediment during the construction phase if a severe storm occurs during installation or before the restoration treatments are fully installed and established. Riparian water tables would be elevated and following this rewetting, the soils could support wetland and become hydric over time. Riparian organisms would have increased access to both water and wet areas.

Several short-term adverse effects would be associated with land clearing and soil disturbance during the construction phase. Removal of large canopy trees during construction would result in a temporary increase in water temperatures due to loss of canopy cover. Exposed soils during construction could temporarily increase erosion and sedimentation, resulting in an increase in turbidity and decreased water quality in the streams and the Broad River. Construction activities could cause temporary sediment deposits to form in the stream channels, primarily at the tributary confluences, which may adversely affect the movement of aquatic organisms and connectivity to instream habitat and forage areas. Construction equipment access and land clearing could result in temporary soil compaction and rutting in construction areas and on roads. Reconnecting the streams to floodplains could cause a short-term decrease in streamflow/water yield (mostly in headwaters) until the surrounding soils become saturated.

Reduced flow may also be associated with the installation of below surface, groundwater dams with logs and clay fill that could be used to help elevate groundwater and provide grade control for the channel. These subsurface groundwater dams would help detain and store

stream water as water tables elevate during and after construction. The elevation of localized water tables adjacent to the stream channels could support more permanent flow in the streams, and would also benefit riparian and aquatic habitats. With time, as water tables elevate some upland plant species may die and be replaced with water tolerant species that can also tolerant intermittent drier periods. Theoretically, as the shallow groundwater reservoir is replenished, it would better sustain baseflow to streams.

The following paragraphs describe the specific benefits and adverse effects associated with each of the three restoration approaches that would be employed to reestablish floodplain connectivity within the Project Area, based on site-specific conditions (Chapter 2).

The higher streambed elevation associated with implementing the P1-floodplain reconnection approach would enable floodwaters to access the valley surface, raise the local water table to rehydrate the riparian area and floodplain, and reduce erosion of the streambanks during periods of high flow. This approach would involve filling the existing channel and relocating a stable, sinuous channel on the valley surface. Stream sections that have a suitable sinuous form could be reused, but at the higher level.

To accomplish this approach, the final design must either start at an existing knickpoint (i.e., a natural grade-control feature, such as bedrock, that provides a large elevation change) or transition slowly from a deeper channel (e.g., P2-flooplain excavation/P3-floodplain bench) into a P1-floodplain reconnection by decreasing the valley slope. Field verification of all the starting locations (Figure 2-2) would be important, particularly when restoration designs tie the starting point into an existing knickpoint using the P1-floodplain reconnection approach. The starting locations are approximations; specific field conditions and construction details would be needed to prepare detailed designs. For example, the actual starting locations could be different than those shown in Figure 2-2 because streambed elevations or dimension could change before the final design process begins. The design criteria for the identified stream, however, would remain the same.

Implementing the P2-floodplain excavation approach would create a new floodplain near the current bankfull elevation, enabling floodwaters to access a new floodplain and alleviating erosion of the streambanks during periods of high flow. The existing valley surface would be excavated over a width of approximately 25 to75 feet on either side of the stream. Where needed, the old channel may be filled and a new channel may be located to provide the needed sinuosity and connectivity to its constructed floodplain. Areas of the former valley width would become a terrace, and potentially loose further connectivity to a valley water table, but may remain intact based on well dispersed rainfall and surface or groundwater contributions from adjacent colluvial hillslopes. As the valley groundwater tables increase in elevation, the terrace water tables may adjust.

The P3-floodplain bench approach typically would be implemented where the channel is not so deeply entrenched, where it is stabilizing naturally, or where other constraints (e.g., private ownership) prevent significant changes. The stream typically would be kept in place, and small benches or locally widening of the existing channel would be excavated near the current bankfull elevation to moderate erosion of the streambanks during periods of high

flow. These types of stream stabilizations would be more surgical in working to stabilize existing conditions without either the fill required in P1-floodplain reconnection or the excavation for P2-floodplain excavation. In-channel structures such as J-hooks and Cross Vanes may occasionally be needed to dissipate stream energy (Rosgen 2001).

At various points in the Project, small, tributary channels with ephemeral or poorly defined indicators of flow permanence enter the main channel from adjacent hillsides, small valleys, and headwater areas. These lateral channels may convey water, sediment, and organic matter from small sub-watersheds and headwater areas to the Project channels shown in Figure 2-2. Although these small connecting channels may or may not be well defined, (i.e., lack perennial flow or have uncertain flow regimes) and were not features displayed on the overview map, it will be necessary to address these areas during the design process to provide hydraulic continuity and ecosystem functionality.

In general, the following two design approaches may be used to address these lateral or headwater channels: step-pool channel design and floodplain pool design. Floodplain pools are usually preferred over step-pool channels because floodplain pools provide more functional lift by retaining water, sediment, and organic matter. Floodplain pools would support more diverse aquatic ecosystems by creating wetland habitats.

Floodplain pools would be used to tie a lateral channel into the main channel where the valley is wide enough to construct the pool. Generally, floodplain pools would be used for ephemeral channels and would mimic an oxbow pool/pond configuration. When feasible, floodplain pools would be created within a portion of the existing lateral or headwater channel or an abandoned channel. Alternatively, wet meadows may be constructed in the floodplain in some cases where flows are ephemeral or intermittent. If site conditions permit, the flows entering the pool or low gradient meadow would be allowed to soak into the ground rather than being directed through a constructed outlet channel. If the tributary drainage is too large, a small step-pool channel would be designed to tie the floodplain pool into the Project channel. If conditions suggest a meandering or braided channel is more appropriate to increase the potential for and maintenance of wetlands, grade control using groundwater dams, constructed with logs or other materials, may be added to prevent future channel headcutting. Groundwater dams may be constructed from suitable clay or compacted fill materials. Under saturated soil conditions, large wood may also be used to construct groundwater dams because the longevity of the wood would be prolonged.

Step-pool channels would be designed to connect lateral or headwater channels with main Project channels primarily in areas where the transition from the ephemeral or intermittent tributary to the Project reach is steep, or in areas where the valley is narrow. The bed profile and dimension of the lateral or headwater channel would be adjusted to create a series of drops and pools that transition the elevation of the lateral or headwater channel down into the Project channel. The steps and drops would be constructed of boulders and smaller rock to provide long-term grade control, and the pools would be designed to dissipate energy. Design criteria for the spacing, length, and size of the step-pools would be based on reference streams and existing design criteria for areas with similar slopes. The structures would mimic

natural rock-step pools and riffles and not appear as rock check dams with significant drops in elevation.

Measures that reduce impacts on water quality and ensure channel stability in the Project Area are identified in Forest Plan standards, BMPs, Region 8 Soil and Water Conservation Practices Guidance, National Best Management Practices, SCDHEC Erosion and Sediment Control Standards and in normal contract language for stream restoration, timber harvesting, road construction/maintenance and other ground disturbing activities.

During construction, erosion sediment and stormwater controls would be monitored as part of a Project specific SWPPP that incorporates Forest Service BMP and other standards. Construction monitoring would identify potential maintenance needs to remain compliant with the SWPPP in preventing erosion and sediment-laden concentrated flow from reaching streams. In some instances, sediment could be captured and removed. Seeded and planted vegetation would be monitored for survival and replaced when needed.

Post-construction monitoring would include monitoring stream channel morphology as a basis for identifying maintenance needs and other potential interventions as part of an adaptive management process.

Temporary bridges or culverts that reduce the extent and impact of filling adjacent to streams would be employed as feasible to help limit Project effects. No new system roads would be constructed. Temporary roads would be built for short-term use only, but this may last for several years. Temporary culverts and bridges may be needed for ease of installation, low disturbance and aquatic passage along with surfacing material and reverse-grades along road sections to control water. The temporary roads would be maintained during the time of use and would not be open to public use.

Sediment fences, temporary seeding of stockpile soil material, “no-cut” buffers and other erosion, sediment and stormwater control measures would be used as needed in the soil borrow and disposal areas and construction staging areas, in accordance with Forest Plan standards.

After stream restoration is completed, temporary roads, staging areas, soil borrow and disposal areas, skid roads and trails, and landings would be closed and revegetated to reduce erosion and associated sedimentation effects on water quality. BMPs used in these areas would include dips, water diversions or water-bars, disking, seeding with an appropriate native grass/forb mixture, fertilization, and mulching, as needed. Mitigation measures would include minimizing exposed bare soil and concentrated water flow that leads to erosion and sediment delivery to streams. Diverting and draining water from roads, exposed soils, and skid trails and landings in small amounts, into forest or vegetated areas would reduce concentrated water flows that contribute to soil erosion and deliver sediment to streams.

3.3.5 *Cumulative Effects of Alternative 2-Proposed Action*

Within the foreseeable future, management of national forest system lands involves a variety of activities ranging from road and trail maintenance, to timber harvesting and wildlife management activities. These activities are implemented under the standards for protecting

soils listed in the Forest Plan (USFS 2004a) and cumulative effects from these actions are minimal. As indicated by the soil sediment production estimates listed in Table 3-5 which include sediment estimates for reasonably foreseeable Forest Service actions within the Project Area, full implementation of Alternative 2-Proposed Action would result in an 86 percent (84,040 tons) reduction in streambank erosion within the Project Area over a 10 year period. This reduction greatly off-sets sediment production estimates associated with other Forest Service activities. Additionally, Alternative 2-Proposed Action includes considerable lift to hydraulic function and geomorphologic function, largely associated with restoring floodplain connectivity and channel stability. Furthermore, stream restoration under this alternative, when combined with other restoration work in Hughes Creek, would lead to significant improvement in watershed condition both in the short- and long-term.

3.4 AIR

3.4.1 *Affected Environment*

The U.S. Environmental Protection Agency (EPA) classified South Carolina as attaining National Ambient Air Quality Standards (NAAQS) for all criteria pollutants except ozone (USEPA 2013 as cited in Atkins 2013a). The eastern portion of York County is listed as a marginal non-attainment area for the 8-hour ozone standard. York County is northeast of the Project Area within the larger region that the Clean Air Act of 1999 requires agencies to consider protecting from air pollution emitted both within and outside of their jurisdictional borders (Figure 1-1). The eastern portion of York County is part of the larger Charlotte-Gastonia-Rock Hill non-attainment area, part of which is not attaining the 1-hour ozone standard (Atkins 2013a).

Table 3-12 summarizes recent data from air quality monitoring stations near the Project Area. The monitoring stations closest to the Project Area are located in urban areas that are likely to encompass more sources of air pollutants than the Project Area, and pollutant concentrations tend to decrease with distance from the source; therefore, the ambient concentrations reported in Table 3-12 are likely to be greater than would be observed within the Project Area.

TABLE 3-12: AMBIENT AIR CONCENTRATIONS OF CRITERIA POLLUTANTS NEAR THE PROJECT AREA

Pollutant [NAAQS]	2010		2011		2012	
	Station	State Average	Station	State Average	Station	State Average
Carbon Monoxide (Station: Greenville ESC ~53 miles west-northwest)						
8-hr Average [9 ppm*]	1.3	0.8	1.1	1.0	1.3	1.2
1-hr Average [35 ppm]	2.1	1.4	1.7	1.5	1.5	1.5
Nitrogen Dioxide (Station: Sandhill ~46 miles south-southeast)						
Annual Average [0.053 ppm]	0.005	0.006	0.0567	0.0582	0.0428	0.0417
Ozone (Station: York ~20 miles northeast)						
8-hr Average [0.075 ppm]	0.067	0.069	0.064	0.069	0.074	0.074
Coarse Particulate Matter (Station: Cayce ~50 miles south-southeast)						
24-hr Average [150µg/m3**]	80	66.2	96	58.3	74	44.3
Fine Particulate Matter (Station: TK Gregg ~30 miles northwest)						
Annual Average [12 µg/m3]	11.4	10.8	11.0	10.6	9.8	9.3
24-hr Average [35 µg/m3]	32.2	33.5	22.8	33.3	18.6	25.9
Sulfur Dioxide (Station: IRMO ~48 miles south)						
1-hr [0.075 ppm]	0.016	0.050	0.120	0.044	0.041	0.016
Lead (Station: 2010- Jenkins Ave.; 2011, 2012 - Bates House/Parklane ~48 miles south-southeast)						
Rolling 3-mo. Average [0.15 µg/m3]	0.006	0.004	0.006	0.013	0.02	0.013

* ppm - parts per million
**µg/m3 - (one-millionth of a gram) per cubic meter air

Source: USEPA 201l; SCDHEC 2013b as cited in Atkins 2013a

The criteria pollutants of most concern for the Sumter National Forest are particulate matter and ozone. The two main activities that cause air pollution within the Sumter National Forest are vehicular traffic and prescribed fires. Both of these activities emit pollutants that can increase the concentrations of ozone and fine particulate matter. Fine particulate matter is the leading cause of regional haze that can impair visibility. Ozone can harm sensitive vegetation within the forest. At elevated concentrations, both pollutants can impair the health of both employees of and visitors to the Sumter National Forest. In 2012, 30,000 acres of hazardous fuel was burned across the entire National Forest, and the prescribed fire did not hinder the state's ability to meet air quality or visibility goals (USDA 2013a as cited in Atkins 2013a).

3.4.2 *Direct and Indirect Effects of Alternative 1-No Action*

There would be no anticipated adverse impacts on air quality under Alternative 1-No Action.

3.4.3 *Cumulative Effects of Alternative 1-No Action*

Existing prescribed burning activities would continue on national forest system lands around and within the Project Area. The annual monitoring report for the Sumter National Forest would continue to monitor air quality in the Enoree Ranger District. The entire Sumter National Forest is classified as attaining all six criteria pollutants.

3.4.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

Stream restoration activities would be conducted using heavy machinery which generates emissions in a localized area. Minor and temporary increases in carbon monoxide (CO), nitrogen oxides (NOx), and hydrocarbons would occur in the Project Area. In addition to tailpipe emissions from heavy equipment, increased vehicle traffic along paved, unpaved, and gravel roads, as well as temporary disturbance of ground surface during stream restoration and vegetation management activities, could potentially cause increases in fugitive dust. These impacts would be temporary and limited to periods of high vehicle traffic and activity.

Construction of temporary roads would add minor additional sources of tailpipe emissions from vehicle use on these roads on a temporary basis. All temporary roads would be obliterated upon Project completion. Minor and temporary increases in carbon monoxide, nitrogen oxides and hydrocarbons would also occur as a result of proposed road reconstruction and maintenance operations; however, these operations would occur over a comparatively short time period and would not likely result in substantial effects to air quality.

Effects on air quality from proposed activities and connected actions would be temporary; no long-term effects would result.

3.4.5 *Cumulative Effects of Alternative 2-Proposed Action*

Other forest management activities such as periodic prescribed fires have the potential to create temporary minor impacts to localized air quality. The changes are dependent on weather conditions, timing, characteristics of the area (fuel loadings and time period since last burning) and the size of the area being burned. In general, impacts are most frequent in the local area of the burn where large quantities of smoke can be produced over a short period of time (USDA, 1989a). Prescribed burning in the Project Area would only take place when conditions are favorable for smoke dispersal.

Additional detailed discussion and analysis of the potential impacts from prescribed fire on air quality are discussed in the Guide to Prescribed Fire in the Southern Forests (USDA, 1989a) and the Vegetation Management of the Coastal Plain/Piedmont EIS (USDA, 2002). Detailed analyses from these documents are incorporated by reference.

3.5 CLIMATE CHANGE AND CARBON STORAGE

3.5.1 *Affected Environment*

On January 16, 2009, the Chief of the Forest Service directed the National Forests to consider two kinds of effects of climate change during project planning: the effect of climate change on a proposed project, and the effect of a proposed project on climate change. The affected environment for climate change, therefore, is two-fold. Climate change may affect the natural resources within the four watersheds in the Project Area (i.e., Clarks Creek, Little Turkey Creek, McCluney Branch, and an unnamed tributary to Clarks Creek), and the proposed stream restoration within those watersheds has some potential to affect greenhouse gas (GHG) emissions, carbon sequestration, and storage in Chester County. Greenhouse

gases affect climate globally by trapping heat in the atmosphere. The influence of GHG emissions on climate change is cumulative and is distributed globally; therefore, the affected environment for any changes in GHG emissions and carbon sequestration and storage associated with the stream restoration alternatives would be the global environment.

Although water vapor is considered a GHG, its net contribution to global climate change is uncertain because 1) it produces cloud cover that reflects sunlight away from the Earth, counteracting its effect as a GHG; and 2) it increases as the Earth warms, confusing the determination of whether increasing atmospheric water vapor is a contributor to climate change or an effect of climate change (NOAA 2013 as cited in Atkins 2013b). Forest evapotranspiration affects atmospheric water vapor, cloud cover, and precipitation; the affected environment for any changes in forest evapotranspiration associated with the alternatives would be regional.

The U.S. Global Changes Research Program published a 2009 report (USGCRP 2009) on climate changes for different regions. Predictions for the Southeast include: air temperature increases; sea level rise; changes in the timing, location and quantity of precipitation; and increased frequency of extreme weather events such as hurricanes, heat waves, droughts and floods. These predicted changes would affect renewable resources, aquatic and terrestrial ecosystems and agriculture, with implications for human health.

Effects associated with global climate change that are likely to occur within the Project Area include changes in air temperature, precipitation, water supply, water quality, and biodiversity. The Template for Assessing Climate Change Impacts and Management Options (TACCIMO) (USDA 2013b as cited in Atkins 2013b) was used to assess differences in three general circulation models using three different emissions scenarios for Chester County, South Carolina, to predict the probable changes in temperature and precipitation within the county (Atkins 2013b). Average annual temperatures in Chester County are estimated to increase by 5.4°F from 63.86°F in 2010, to 66.38°F in 2050, to 69.26°F in 2090. Estimates of monthly precipitation for Chester County indicate a slight increase from an average of 95.7 millimeters (mm) in 2010, to 95.8 mm in 2050, to 97.1 mm in 2090.

3.5.2 *Effects of Climate Change on the Project Direct and Indirect Effects of Alternative 1-No Action*

Alternative 1-No Action would have no short-term effects on the current trend for carbon storage or release in the Project Area. The Project Area would continue to experience more variability in weather conditions including extreme (in duration, magnitude, and occurrence) droughts and flood events. Project Area streams would continue to experience bank instability, sloughing, and erosion and sedimentation, resulting in a long-term decrease in the overall stream function.

3.5.3 *Cumulative Effects of Alternative 1-No Action*

Past and present Forest Service projects include, but are not limited to, periodic prescribed burning, woodland creation and thinning (pulpwood, and intermediate), wildlife habitat opening maintenance, and trail creation. These activities have reduced hazardous fuels, improved growing conditions for trees, and increased diversity of habitat conditions on

national forest system lands. Keeping already thinned stands at full stocking levels rather than letting them become overstocked and unhealthy have optimized the storage of carbon and reduced drought related mortality. Wildlife and plant species have thrived in the increased diversity brought about by creating diverse stand and habitat conditions.

Substantial changes in land use in the Project Area are not anticipated under Alternative 1-No Action. Potential gains and losses of carbon would be subject to changes in land-use, such as the conversion of forests to agricultural lands. Increase urbanization is occurring on private lands around the forest; however, national forest system lands provide for the long-term management of forested areas to offset these other changes in the piedmont.

3.5.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

Alternative 2-Proposed Action would initially release carbon through soil disturbance and tree cutting and initially leave fewer trees to store carbon, but would also create and maintain an herbaceous layer with a capacity for long-term carbon storage and which may be more resistant to long-term climate change. Restoring streams in the Project Area would increase stream functions, including the ability for restored streams to tolerate predicted changes to air temperature increases, changes in the timing, location and quantity of precipitation, and increased frequency of extreme weather events such as hurricanes, heat waves, droughts and floods. Restored streams would reconnect to the floodplain, functioning as such in periods of high flow events. Increased stream bank stability would provide opportunity for aquatic organisms and habitat to remain in the streams under various precipitation scenarios and overall extreme weather conditions.

The connected actions associated with implementing Alternative 2-Proposed Action include road reconstruction and temporary road construction, timber harvest, and soil borrow and soil disposal. There would be a temporary increase in vehicular traffic, particularly large construction vehicles. The timber harvest would be minimal compared to traditional timber harvests so there would likely be no effect to carbon gains and losses from timber harvest for the Alternative 2-Proposed Action.

3.5.5 *Cumulative Effects of Alternative 2-Proposed Action*

Alternative 2-Proposed Action combined with other past, present and future Forest Service projects would result in increased stream functions and reduced erosion and sedimentation, reduced hazardous fuels, improved growing conditions for trees, and increased diversity of habitat conditions on national forest system lands. Forested areas would be more open following stream restoration in the short-term, resulting in increased growth on residual trees with a proliferation of understory plant growth including pine and hardwood trees, forbs and grasses. As a result, the forest, especially the Project Area, would be better able to adapt and withstand stresses brought about by dryer conditions that may be experienced as part of climate change.

Periodic prescribed burning in the area would reduce the risk of wildfires in the area that could result from drier conditions. Keeping already thinned stands at full stocking levels rather than letting them become overstocked and unhealthy would optimized the storage of carbon and reduce drought related mortality.

Alternative 2-Proposed Action would not affect land uses in the Project Area.

Successional stages in the Project Area and watersheds would range from very early, early middle, late and old being roughly tied to age classes. Revegetation efforts following restoration would encourage stand density and avoid creating large areas of monoculture pine, as these conditions are often highly susceptible to drought and subsequent southern pine beetle attack and mortality.

3.5.6 *Effects of the Project on Climate Change*

Continued implementation of all Forest Service projects would continue to provide some level of terrestrial sequestration; however, tree clearing would continue to result in a release of carbon dioxide.

At a global or national scale, the short-term reduction in carbon stocks and sequestration rates of Alternative 2-Proposed Action are imperceptibly small, as are the potential long-term benefits.

3.6 ROADS AND BRIDGES

3.6.1 *Affected Environment*

The transportation system for the Project Area is complete; based on field review by Forest Service engineers, it is estimated that approximately 23 miles of Forest Service system roads would need to be reconstructed including the replacement/reconstruction of three bridges (refer to *2014 Francis Marion and Sumter Travel Analysis Process (TAP)* report in the Project file). Approximately 13 miles of temporary roads would need to be constructed to access the Project streams. There are also three state roads within the Project Area: S-574 (2 miles), S-535 (1.7 miles), and S-49 (1.9 miles). These roads would need reconstruction, including repaving/chip-sealing, and a bridge that crosses Clarks Creek would probably have to be replaced.

Forest system roads are divided into five levels for maintenance purposes: 1) level 1 roads are closed/intermittent service roads, 2) level 2 roads are open for use by high clearance vehicles, 3) level 3 roads are maintained for safe and moderately convenient travel suitable for passenger cars, 4) level 4 roads have higher average daily traffic and are generally a through route, and 5) level 5 roads are generally arterial roads and routes into special locations, such as recreation campgrounds. User comfort and driving ease are increasingly important considerations from level 3 to level 5 (USFS 2004).

Forest system roads are assessed for risk and benefit for any proposed forest project. The risk compares the current condition of the road to the desired condition and then uses specific criteria to determine the risk for effects on: terrestrial plants and PETS, aquatic organism passage, hydrologic modification, sediment delivery, NNIS, public safety/law enforcement, and social setting impacts. Similarly, the Forest Service provides a qualitative assessment of the “benefits” (low, medium, and high) that the roads provide. The Project Area is popular for hunting and horseback riding and the roads within the Project Area provide access to numerous recreation facilities and trails and there is considerable public use. Access from

roads is also available to local cemeteries. In addition to these uses, the roads provide resource management access for wildlife opening maintenance and prescribed burning. Some roads in the Project Area are closed seasonally to benefit wildlife.

Table 3-13 describes the Forest system roads within the Project Area, their designated maintenance level, and the risk/benefits associated with those roads.

TABLE 3-13: FOREST SYSTEM ROADS IN THE PROJECT AREA

Forest System Road Number	Risk/Benefit	Total Mileage of Forest System Road (miles)	Existing Road Maintenance Level
301	High/High	5.2	4
305K/E9-1	High/High	0.6	1
301A	Low/Low	0.6	1
301C	High/Medium	1.6	3
301E	High/High	2.5	3
301F	High/Medium	1.4	2
301H	Low/Low	0.6	3
305	High/High	3.1	4
305B	Medium/Medium	1.0	1
305D	High/High	0.7	3
305E	Low/Low	1.1	2
305F	Low/Low	0.4	3
305G	Low/Low	0.8	1

Specific information on Project Area roads is contained in the Francis Marion and Sumter Transportation Analysis Process report (TAP) in the Project file.

3.6.2 *Direct and Indirect Effects of Alternative 1-No Action*

Under Alternative 1-No Action, road reconstruction within the Project Area would not occur in the short or near term. Roads would continue to exist at their current condition, which may or may not be consistent with the desired maintenance level. Due to limited government funding, road maintenance activities would occur sporadically within the Project Area due to a projected decrease in government funding for road maintenance over the next decade. For roads not meeting their designated maintenance level, visitors and residents may find these roads increasingly difficult or uncomfortable for passenger cars to travel. Some of the Project Area roads would also continue to erode, adding sediments directly into the Project watershed.

3.6.3 *Cumulative Effects of Alternative 1-No Action*

There are approximately 472 miles of Forest system roads within the Enoree Ranger District. Many of these roads are not at their desired maintenance level. Other Forest management

activities, such as timber harvesting, prescribed burning, and wildlife openings maintenance would have continued adverse impacts on roads if they were not reconstructed or maintained to their desired maintenance level. *Sericea lespedeza* is a known invasive species that is very prevalent along Forest system roads in the Enoree Ranger District. The Forest Service has an environmental assessment and Decision Notice in place for herbicide treatments of *Sericea lespedeza* and other NNIS plants. The Forest Service has placed emphasis on eliminating NNIS plants along roadways and replacing it with native vegetation. This would continue under this alternative.

3.6.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

Implementing Alternative 2-Proposed Action would temporarily increase traffic on Forest system roads and state roads within the Project Area. Increased traffic would include large construction vehicles hauling heavy equipment and soil on the roads in the Project Area. This type of traffic typically temporarily increases noise and dust. Load limits may need to be increased and Project roads would need, at minimum, additional gravel and brought up to their designated maintenance level. Traffic controls and signing would be used to control Project and public traffic to maintain public safety and any road closures, such as gates, would be used on the temporary roads.

System road reconstruction activities for the Project include grading, spot surfacing with crushed stone, replacement of damaged and non-functional culverts, installing or replacing gates, correcting road safety hazards and brush removal to enhance visibility may be necessary to ensure safety and prevent environmental degradation during Project implementation. The specific reconstruction activities would be applied based on the current maintenance level assigned for each Forest system road. Reconstruction and maintenance would reduce identified resource risks while providing Project access. Implementing Forest Plan standards, BMPs and site-specific mitigation would also reduce adverse effects to other resources particularly those related to erosion and sedimentation in streams as a result of road use.

Concurrently, approximately 13 miles of temporary roads would be constructed within the Project Area. These roads would be designed to: transport equipment into and out of the Project streams; haul excavated soil material to disposal areas or to obtain appropriate borrow soil and other material (e.g., wood, boulders, gravel) to use in stream restoration. These roads may be graveled and water control structures installed to control runoff and reduce erosion and sedimentation into streams. Temporary bridges may be needed for Project streams to facilitate access from one side of the stream to the other. This would reduce channel crossing excavations reducing soil erosion and sedimentation. Use of woody material and matting in riparian areas would be used in lieu of aggregate surface material. This would reduce rutting and compaction of soils and allow for rehabilitation of roads in riparian areas. Some temporary roads use would occur on old woods roads that have been converted to horse trails. Once Project activities are completed, the roads would be rehabilitated. Rehabilitation work would include, but not be limited to, permanent road closures, removing any temporary culverts used and restoring natural drainage including out-sloping of road to reduce erosion and sedimentation. Soil ripping, disking, smoothing, liming, fertilizing and seeding would be completed as soon as the road is no longer needed. These actions would

reduce soil compaction, increase water infiltration and reduce overland water flow thus reducing erosion and sedimentation. It would also speed up the recovery of native vegetation. Temporary roads co-located with existing horse trails would be returned to use as trails and rehabilitation would emphasize using trail tread material suitable for horses. These actions would reduce adverse effects to recreation users.

In addition to reconstruction of affected Project Area roads, three Forest Service bridges in the Project Area would need to be reconstructed and/or replaced, depending on the stream restoration work. Some bridges may need to be wider or raised in elevation to accommodate overbank flow based on the 100-year flood of the restored streams. Project Area bridges may need additional structural reinforcement for larger, heavier vehicle traffic to occur. A state road bridge would be impacted and may require replacement or some level of reconstruction since it crosses a stream that is proposed for restoration. Some culverts will need to be replaced. Reconstruction and maintenance of roads in the Project Area would reduce the risks and bring roads up to their designed maintenance level identified in the Francis Marion and Sumter National Forest TAP report. This will reduce adverse impacts to the resources and improve public safety.

Impacts from other connected actions include timber harvest. Temporary skid trails and logging areas would occur in the Project Area. Temporary roads would be closed and obliterated and measures employed to control erosion and stormwater runoff that could cause sedimentation in streams. Road surfaces would be replanted with native and desirable non-native vegetation which would reduce the reestablishment of NNIS plants. To address the accidental introduction or spread of NNIS, the Forest Service would follow standard equipment cleaning contract provisions and limit re-seeding to native and desirable non-native species.

The Forest Service would require development of a transportation operation and maintenance plan prior to commencing any site-disturbing work. This plan would include periodic inspection by the Forest Service and SCDOT during Project activities. All Project activities would include mitigation measures presented in Section 2.4, Chapter 2 of this Final EIS. This will reduce adverse impacts to the resources and improve public safety.

3.6.5 *Cumulative Effects of Alternative 2-Proposed Action*

One additional Forest management project would occur in or near the Project Area during implementation of Alternative 2-Proposed Action: the Georgia Aster/ Shortleaf Pine Woodlands Project. Other concurrent activities would include prescribed burning and recreation and wildlife management. There would likely be some overlap in the use of Forest system roads for these activities which may cause additional traffic and road closures, elevated dust and noise, and impacts to visual resources along the roads. These actions would be minor and temporary. Roads in the Project Area would become better for vehicular traffic if, prior to Project implementation, Forest system roads are brought up to their desired maintenance levels. Implementation of Forest Plan standards and Project-specific design criteria would reduce adverse effects from noise, traffic congestion, and dust for users of the road system and would reduce adverse resource effects.

3.7 VEGETATION, ECOLOGICAL COMMUNITIES AND NON-NATIVE INVASIVE SPECIES

3.7.1 *Affected Environment*

3.7.1.1 Vegetation

Mesic mixed hardwood forests and mixed pine-hardwood forests are the dominant plant communities in the Project Area (Figure 3-21 through Figure 3-24). These two forest types encompass approximately 616 acres and 522 acres, respectively, within Study Area 1 (Atkins 2014d). Relic floodplain bottomland forests cover approximately 76 acres of Study Area 1; occurring along incised stream channels and are most abundant along Clarks Creek. River floodplain hardwood forest covers approximately 7 acres of Study Area 1 and is found on lower McCluney Branch, on Lower Clarks Creek, and adjacent to the Broad River (Figure 3-21).

MESIC MIXED HARDWOOD FOREST

Mesic mixed hardwood forest is the most widespread mid- to late-successional (i.e., not climax) and relatively undisturbed community type in Study Area 1. The canopy is of uneven age; standing and fallen snags are common and create intermittent small gaps in the canopy. Canopy species most often sampled in this community include red maple (*Acer rubrum*), mockernut hickory (*Carya tomentosa*), white ash (*Fraxinus Americana*), sweetgum (*Liquidambar styraciflua*), loblolly pine (*Pinus taeda*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), and winged elm (*Ulmus alata*). Subcanopy and shrub species often include American hornbeam (*Carpinus caroliniana*), flowering dogwood (*Cornus florida*), St. John's wort (*Hypericum hypericoides*), black cherry (*Prunus serotina*), sparkleberry (*Vaccinium arboreum*), and rusty blackhaw (*Viburnum rufidulum*). This community tends to have a sparser shrub layer than mixed pine-hardwood forest; consequently, it supports a more robust herb layer. Typical herbs are Virginia snakeroot (*Endodeca serpentaria*), spotted wintergreen (*Chimaphila maculata*), deer-tongue grass (*Dichanthelium clandestinum*), broadleaf rosette grass (*Dichanthelium latifolium*), licorice bedstraw (*Galium circaezans*), slender yellow wood sorrel (*Oxalis dillenii*), Christmas fern (*Polystichum acrostichoides*), dwarf cinquefoil (*Potentilla canadensis*), and littlehead nutrush (*Scleria oligantha*). Vines are also common, including cross vine (*Bignonia capreolata*), Carolina jessamine (*Gelsemium sempervirens*), Virginia creeper (*Parthenocissus quinquefolia*), yellow passion flower (*Passiflora lutea*), sawtooth greenbrier (*Smilax bona-nox*), cat greenbrier (*S. glauca*), and muscadine (*Vitis rotundifolia*) (Atkins 2014d).

MIXED PINE-HARDWOOD FOREST

Typical canopy species in the mixed pine-hardwood community include loblolly pine, pignut hickory (*C. glabra*), and white ash, along with various oaks including white oak, southern red oak (*Q. falcata*), and northern red oak. The dominant presence of loblolly pine is the most distinctive characteristic of this community. This community often represents an early successional version of mesic mixed hardwood forest or oak-hickory forest that has been disturbed by logging and conversion to pine silviculture in the past. As such, its canopy often has gaps that provide sun exposure for many subcanopy and shrub elements, including flowering dogwood, American hornbeam, silverbell (*Halesia tetraptera*), sourwood (*Oxydendrum arboreum*), black cherry, strawberry bush (*Euonymus americana*), and Elliot's blueberry (*Vaccinium elliottii*). Many canopy and subcanopy elements are remnant species

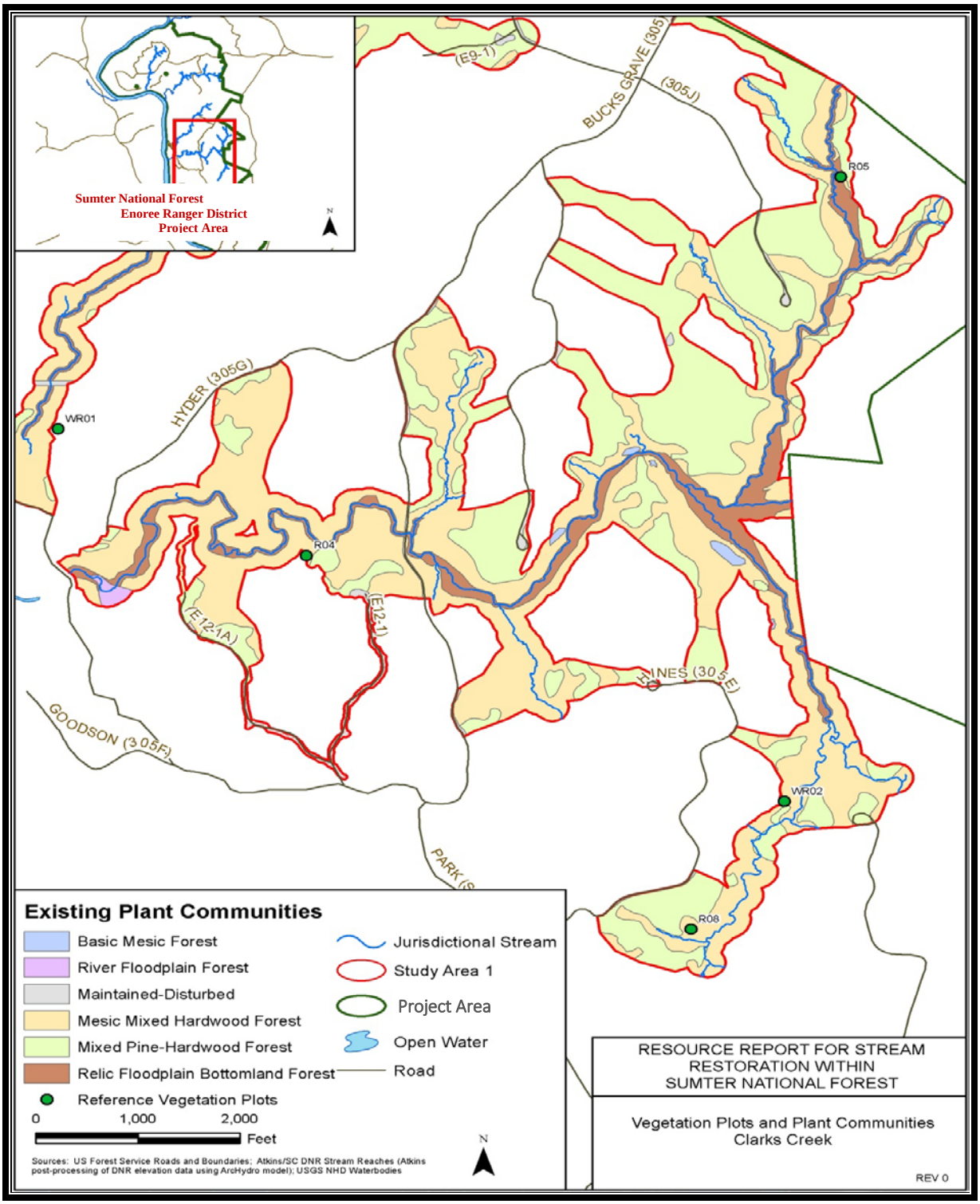
from pre-silviculture plant communities. The age structure of these forests tends to be more even than the other four, more undisturbed plant communities identified within Study Area 1. Herbaceous elements are more abundant where the shrub layer is scant and may include panicled tick-trefoil (*Desmodium laevigatum*), licorice bedstraw, lion's foot (*Nabalus serpentatius*), Christmas fern, black snakeroot (*Sanicula canadensis*), and Solomon's seal (*Polygonatum biflorum).* Vines can include Virginia creeper, cat greenbriar, and muscadine. This community can exist along any hydrologic gradient, but it is most concentrated in uplands and ridgetops, where silvicultural activities are most likely to have occurred (Atkins 2014d).

RIVER FLOODPLAIN FOREST

River floodplain forest occurs on level terrain along river floodplains where the water table is close to the soil surface. This community supports a mixture of flood-tolerant species. Frequent deposition of alluvial sediments makes these communities fertile, but growth is limited due to the stress of flooding. Prolonged inundation may cause widespread mortality; consequently, the oldest trees of a mature river floodplain forest are generally smaller and younger than the other surrounding mature forest communities. The canopy is uneven in age, and snags are common. Canopy species include green ash (*F. pennsylvanica*), black willow (*Salix nigra*), sugarberry (*Celtis laevigata*), overcup oak (*Q. lyrata*), and swamp chestnut oak (*Q. michauxii*). In areas where intensive logging and clearing occurred in past, the floodplain forest may now host an abundance of sweet gum, loblolly pine, and American sycamore (*Platanus occidentalis*). The understory is usually absent but can be dominated by American hornbeam. The herbaceous layer is sparse and consists of hydrophytes, including various sedges (*Carex spp*.), lizards tail (*Sauraus cernus*), jewelweed (*Impatiens capensis*), and false nettle (*Boehmeria cylindrica*). Woody vines such as poison ivy (*Toxicodendron radicans*), cross vine, and various greenbrier are frequently prominent (Atkins 2014d).

RELIC FLOODPLAIN BOTTOMLAND FOREST

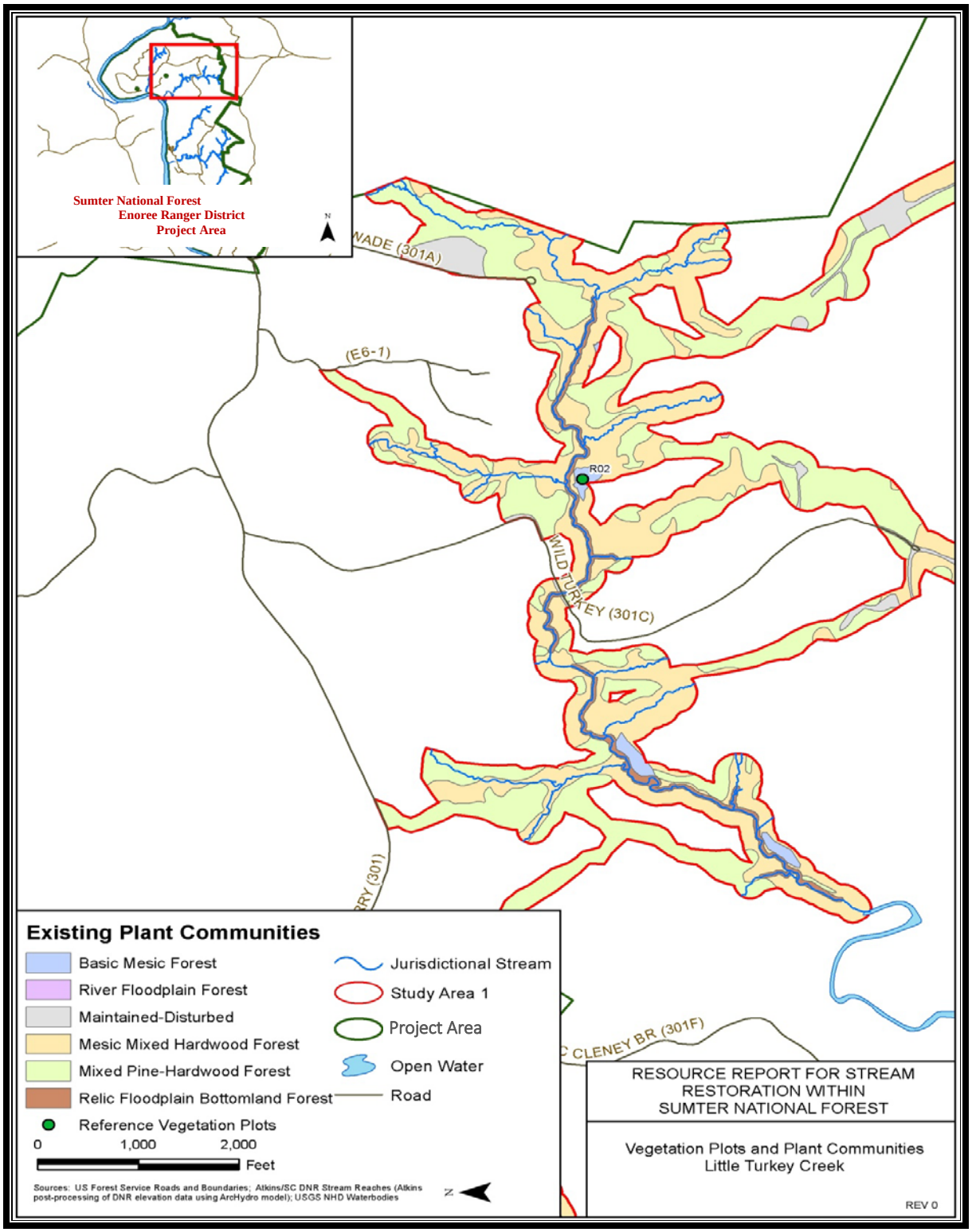
Relic floodplain bottomland forest historically persisted in active floodplains; however, poor land use practices caused streams to cut down to a depth significantly lower than the channel's antecedent elevation. The dramatic change in stream channel elevation resulted in significant drawdown of the local water table. Subsequently, the frequency of flooding has decreased, if not halted entirely, in this forest community. Vegetation composition is similar to that of the river floodplain forest but may be distinguished by greater plant diversity, presence of upland vegetation, and a dense herbaceous layer. These characteristics are the result of a benign hydrologic regime. Furthermore, lower incidence of flooding decreases rates of tree mortality and permits a mature forest of older and larger trees. The canopy is dominated by tulip poplar (*Liriodendron tulipifera*), sweetgum, loblolly pine, red maple, river birch (*Betula nigra*), green ash, American sycamore, and hackberry (*Celtis occidentalis*). Understory species include American hornbeam, southern sugar maple (*Acer floridanum*), red maple, flowering dogwood, American holly (*Ilex opaca*), and pawpaw (*Asimina triloba*). The herbaceous layer is lush and typically diverse where invasive species are absent. Herbaceous species typically include Christmas fern; false nettle; Canadian honewort (*Cryptotaenia canadensis*); violets (*Viola spp.*), various sedges (*Carex spp*.); and grasses, primarily river oats (*Chasmanthium latifolia*), and slender woodoats (*C. laxum*) (Atkins 2014d).



Source: Atkins 2014d

Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

FIGURE 3-21: VEGETATION PLOTS AND PLANT COMMUNITIES CLARKS CREEK



Source: Atkins 2014d

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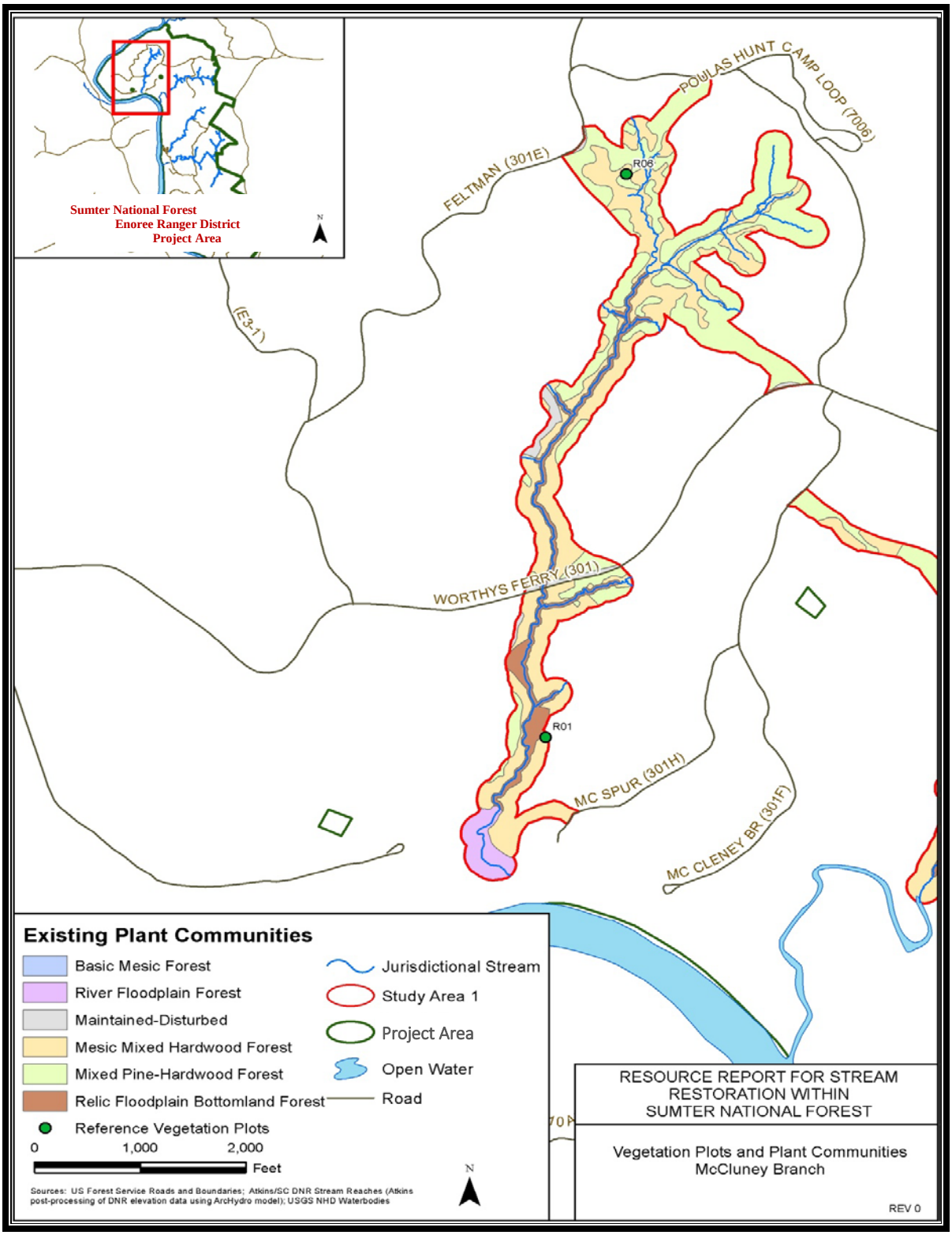
FIGURE 3-22: VEGETATION PLOTS AND PLANT COMMUNITIES LITTLE TURKEY CREEK



Source: Atkins 2014d

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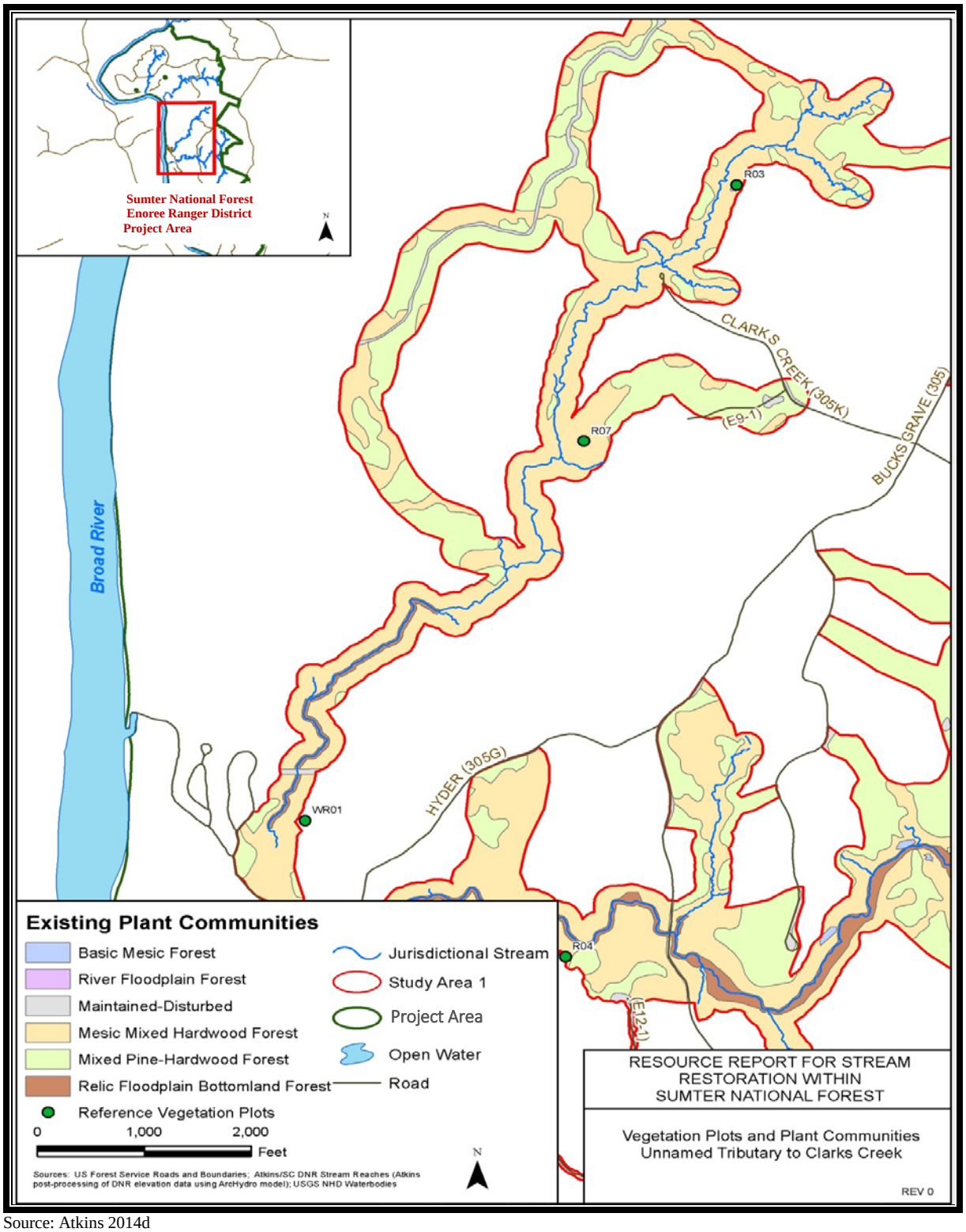
FIGURE 3-23: VEGETATION PLOTS AND PLANT COMMUNITIES MCCLUNEY BRANCH



Source: Atkins 2014d

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FIGURE 3-24: VEGETATION PLOTS AND PLANT COMMUNITIES UNNAMED TRIBUTARY TO CLARKS ECOLOGICAL COMMUNITIES

3.7.1.2 Ecological Communities

RARE PLANT COMMUNITIES

Atkins (2014d) evaluated 19 rare plant community types that were identified in consultation with Forest Service as being potentially subject to the provisions of the rare plant community forest prescription (Table 3-14). Ten basic Piedmont mesic mixed forest (basic mesic forest) remnants were identified as occurring in the Project Area, of which four were greater than 1 acre in size (5.74 acres total).

TABLE 3-14: RARE PLANT COMMUNITIES THAT POTENTIALLY OCCUR ON THE ENOREE RANGER DISTRICT, SUMTER NATIONAL FOREST

Plant Community Group	Rare Plant Community	Discounted or Surveyed For
Bogs, Seeps, and Ponds	Piedmont Gabbro Upland Depression Forest	Surveyed
	Atlantic Upland Depression Willow Oak Swamp Forest	Surveyed
	Piedmont Low Elevation Headwater Seepage Swamp	Surveyed
Riverine Vegetation	Floodplain Canebrake	Surveyed
	Southern Piedmont Oak Bottomland Forest	Surveyed
	American Beech – Southern Sugar Maple/Common Pawpaw Forest	Surveyed
	Piedmont Triassic Basin Oak Bottomland Forest	Discounted–the Project Area is not in the Triassic Basin
Basic Mesic Forests	Basic Piedmont Mesic Mixed Hardwood Forest	Surveyed
Cliffs and Bluffs	Granitic Dome or Dome Woodland	Discounted
Rock Outcrops	Granitic Flatrock	Discounted
Glades, Barrens, and Associated Woodlands	Piedmont Blackjack Prairie	Discounted
	Piedmont Diabase Barren	Discounted
	Piedmont Acid Hardpan Woodland	Discounted
	Piedmont Montmorillonite Woodland	Discounted
	Xeric Hardpan Forest	Discounted
	Mafic Xeric or Dry-Mesic Piedmont Oak Forest	Discounted
	Mafic Shortleaf Pine-Oak Woodland	Discounted
	Rich Granitic Lower Piedmont Deciduous Woodland	Discounted
	Southern Inner Piedmont Mafic Barren	Discounted
Abandoned Mines		Discounted

Source: NatureServe 2001 and USDA 2004a (As cited in Atkins 2014d)

OLD GROWTH COMMUNITIES

Atkins (2014d) identified 13 potential sites of old growth forest in the Project Area. Tree corings and other analyses determined that none of these qualify as existing old growth. Most groups were eliminated from consideration because they did not satisfy the minimum age requirement of the oldest existing age class (USDA 1997, as cited in Atkins 2014d).

3.7.1.3 Non-Native Invasive Species

Although the survey was not exhaustive, Atkins (2014d) documented 10 NNIS occurring in the Project Area (Figure 3-25 through Figure 3-28). The following sections summarize the status of each of these.

TREE-OF-HEAVEN

Tree-of-heaven (*Ailanthus altissima*) was found in 7 locations in the floodplain and on the slopes at unnamed tributary to Clark's Creek (near the Project Area), on a slope along Clark's Creek east of Henderson Road, and on a tributary to the north fork of Clarks Creek (Figure 3-25 and Figure 3-28).

MIMOSA

Mimosa (*Albizia julibrissin*) seedlings were found occasionally in floodplain areas at all Study Area 1 streams (Figure 3-25 through Figure 3-28). The 1- to 2-year seedlings often were located near roads or horse trails; however, some occurred in more isolated areas. On two occasions, a mature tree (a direct seed source) was found. Many of the seedlings were heavily browsed, suggesting that the spread of this species may be exacerbated by herbivore grazing (Atkins 2014d).

THORNY OLIVE

A single individual of thorny olive (*Elaeagnus pungens*) was found along McCluney Branch just south of the Worthys Ferry Road crossing (Atkins 2014d).

AUTUMN OLIVE

Autumn olive (*Elaeagnus umbellata*) appears to be restricted to McCluney Branch and Little Turkey Creek (Figure 3-26 and Figure 3-27). Large, seed-bearing individuals were found at several locations (Atkins 2014d).

SERICEA LESPEDEZA

Sericea lespedeza (*Lespedeza cuneata*), a semi-woody upright forb that grows to 6 feet, is abundant on most roadways in the Project Area. Sericea lespedeza was common along Worthy's Ferry Road, Wild Turkey Road, Clark's Creek Road, Hyder Road, Henderson Road, Hines Drive, Wilkson Road, and roads leading to McCluney Branch, the unnamed tributary to Clarks Creek, the downstream section of Little Turkey Creek, and Little Turkey Creek. Figure 3-25 through Figure 3-28 show individual plants and groups found in floodplains and other off-road locations within Study Area 1 (Atkins 2014d).

CHINESE PRIVET

Chinese privet (*Ligustrum sinense*) occurs in the floodplain areas of all major streams of Study Area 1 (Figure 3-25 through Figure 3-28). This aggressive shrub can be expected to continue to spread in favorable floodplain locations (Atkins 2014d).

JAPANESE HONEYSUCKLE

Japanese honeysuckle (*Lonicera japonica*) was found in greater or lesser abundance in every floodplain and roadside in Study Area 1 (Atkins 2014d).

JAPANESE STILTGRASS

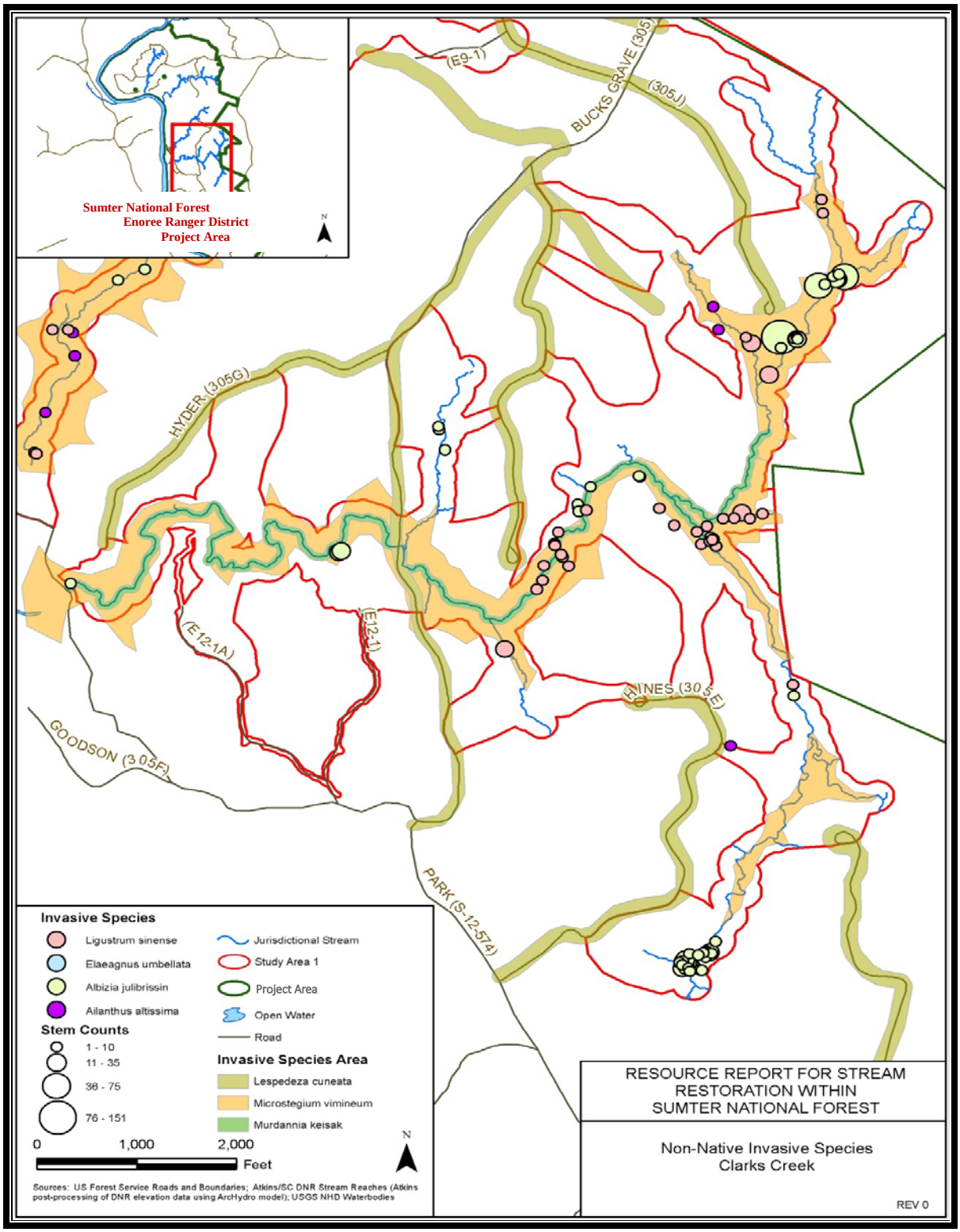
Japanese stiltgrass (*Microstegium vimineum*) colonizes flood-scoured banks through water dispersal of seed and is flood tolerant. It is common in forest edges, roadsides, trailsides, damp fields, swamps, lawns, and ditches. It spreads on trails and recreational areas when seeds adhere to shoes, clothes, and animals. Japanese stiltgrass was established in the floodplain of every major stream in Study Area 1 (Figure 3-25 through Figure 3-28). It can be expected to continue to spread onto lower slopes and throughout most floodplain areas (Atkins 2014d).

MARSH DAYFLOWER

Marsh dayflower (*Murdannia keisak*) is a wetland species that was found colonizing scoured sand banks along the middle and lower reaches of Clarks Creek (Figure 3-25). This species tends to occur in large populations and roots at the stem nodes as it spreads. The seeds of this species are dispersed by wildlife, and root fragments are carried during floods. Since this species probably entered Clarks Creek from the Broad River, it is likely to be present in some of the other stream reaches in Study Area 1 now or in the future (Atkins 2014d).

SACRED BAMBOO

Sacred bamboo (*Nandina domestica*) was found in one location in the upper McCluney Branch floodplain. Seeds of this shrub are often carried by birds (Atkins 2014d).



Source: Atkins 2014d

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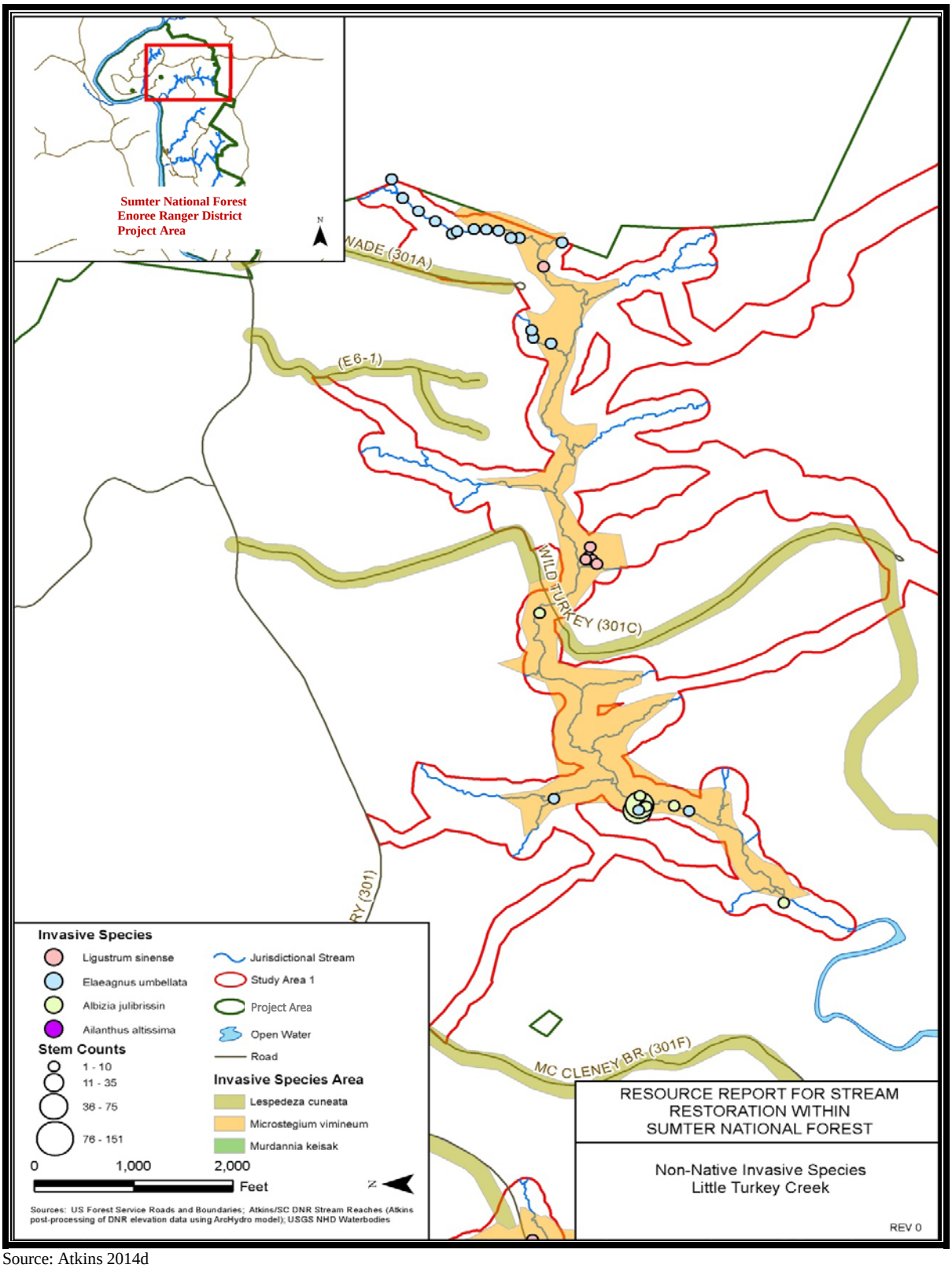
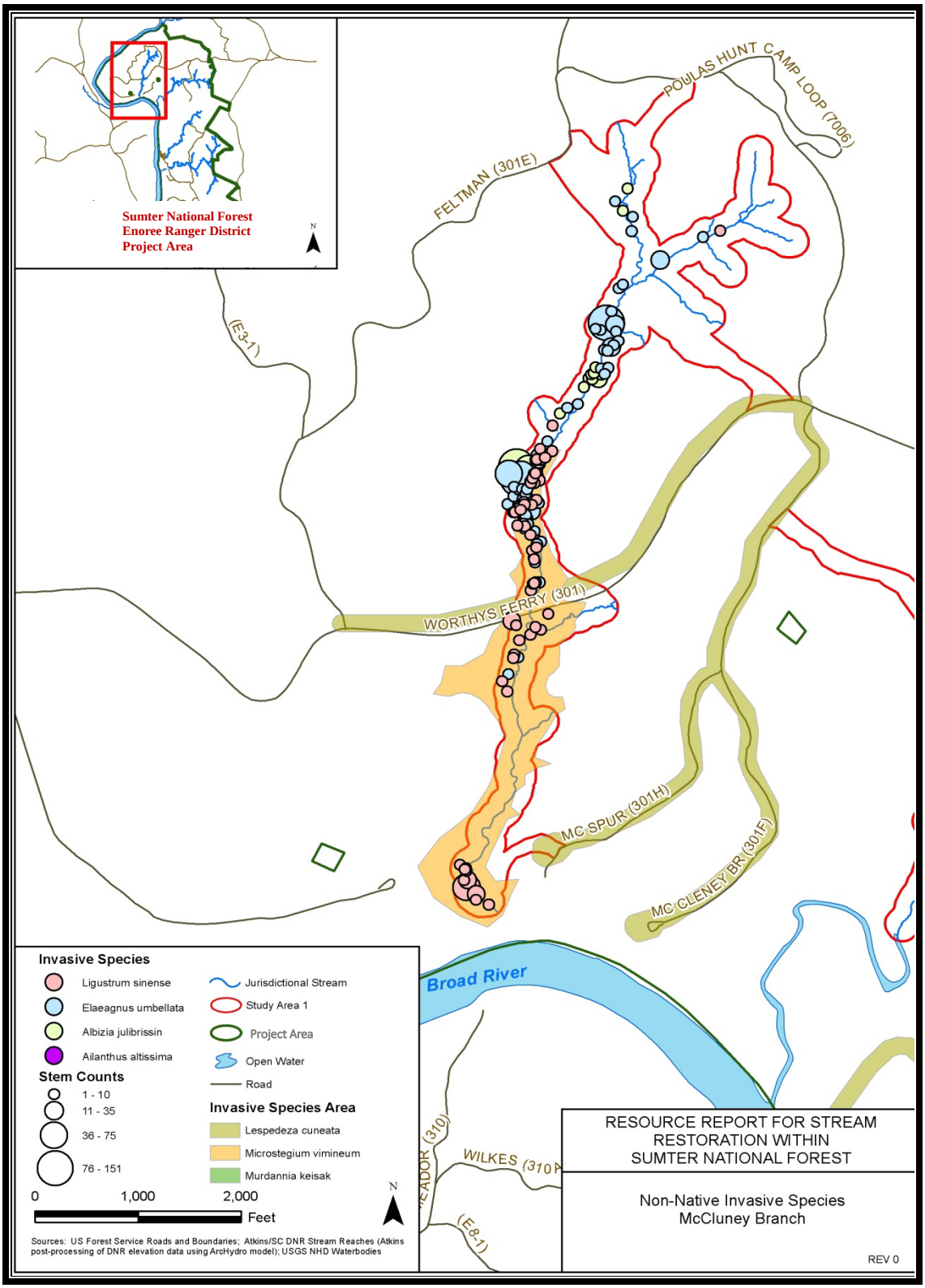
FIGURE 3-25: NON-NATIVE INVASIVE SPECIES, CLARKS CREEK



Source: Atkins 2014d

Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

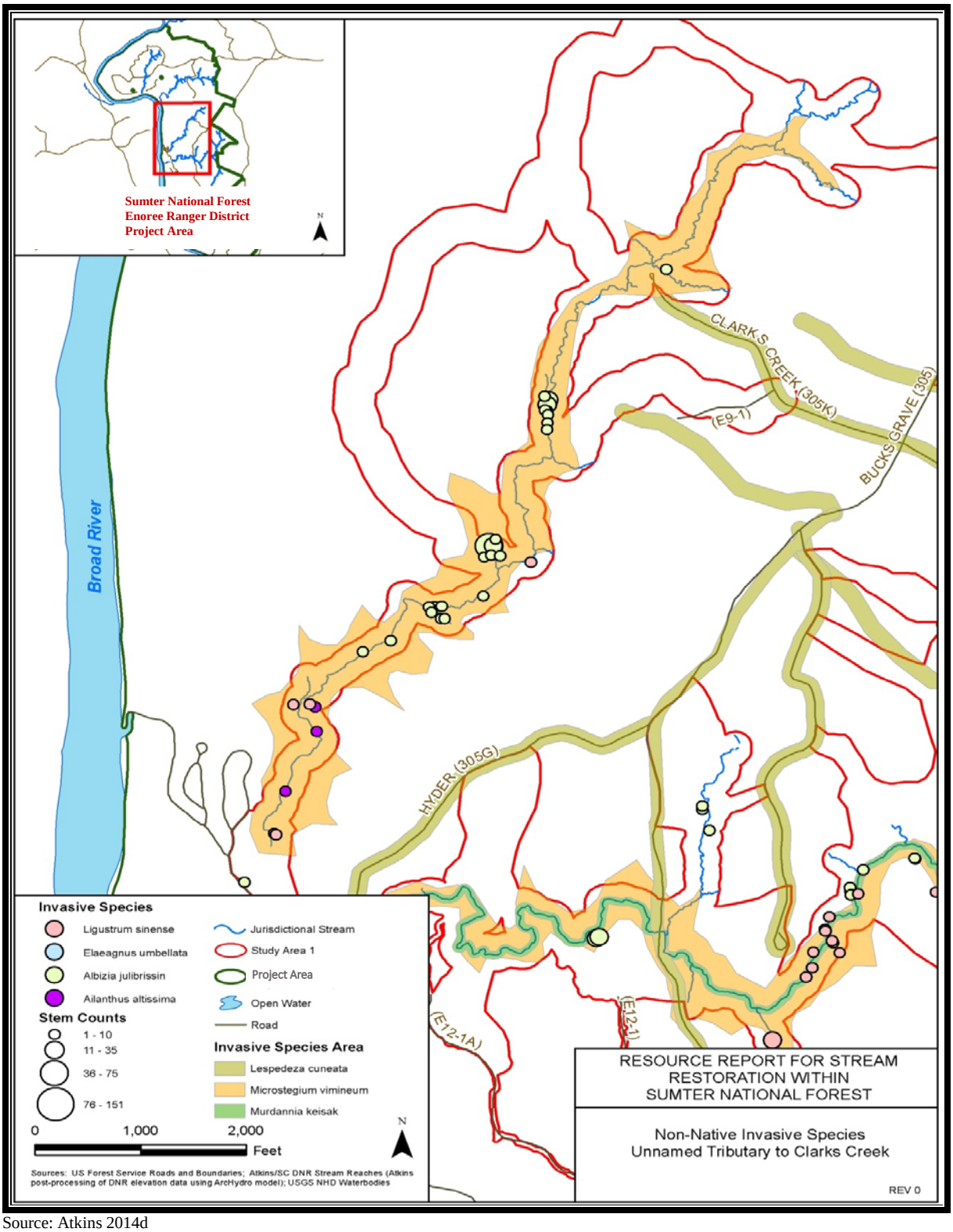
FIGURE 3-26: NON-NATIVE INVASIVE SPECIES, LITTLE TURKEY CREEK



Source: Atkins 2014d

Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

FIGURE 3-27: NON-NATIVE INVASIVE SPECIES, MCCLUNEY BRANCH



Source: Atkins 2014d

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FIGURE 3-28: NON-NATIVE INVASIVE SPECIES, UNNAMED TRIBUTARY TO CLARKS CREEK

3.7.2 *Direct and Indirect Effects of Alternative 1-No Action*

Streambeds would remain deeply incised under Alternative 1-No Action, and vegetative communities would remain mostly isolated from stream hydrology due to lack of floodplain connectivity and reduced water table elevation. The approximately 76 acres of relic floodplain bottomland forest adjacent to the deeply incised stream channels of Study Area 1 would remain hydrologically isolated, which could result in the demise of this stand through competition with upland species, including NNIS, as older trees within the stand begin to lose vigor and senesce.

3.7.3 *Cumulative Effects of Alternative 1-No Action*

Historically, vegetation resources in the Project vicinity and throughout the Piedmont were cumulatively affected by a wide range of incompatible land uses, including extensive clearing for agriculture and widespread timber harvesting and agriculture on steeply sloped terrain and highly erodible soils. Collectively these activities resulted in significant erosion and sedimentation and ultimately significant incisement of streams throughout the region. Under Alternative 1-No Action, these cumulative impacts would persist and floodplain vegetation throughout the Project Area would remain largely hydrologically isolated from the adjacent streams due to lack of floodplain connectivity (i.e., surface hydrology) and reduced water table elevation. Continued hydrologic isolation will result in continued stress on floodplain communities, and in particular the relic floodplain forest noted above, which could ultimately result in their demise over time, which would increase the capability of NNIS to compete with native species and spread within the Project Area. Finally, implementation of Alternative 1-No Action would forego opportunities to remove existing NNIS and replant with native species as part of the proposed restoration activities.

3.7.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

Older stands of mature hardwoods would be cleared during excavation for restoration activities, and some potential old growth forest remnants could be affected by implementing Alternative 2-Proposed Action. Atkins (2013a) identified 13 potential old growth forest sites within the Project Area, including 19.79 acres of mixed mesophytic and river floodplain forests greater than 1 acre in size.

Implementing Alternative 2-Proposed Action could affect rare plant communities though impacts would be minimized during Project planning and associated activities. Of the 19 community types identified as being subject to the rare plant community forest prescription, only basic mesic forest was identified as potentially occurring in the Project Area (Atkins 2013a), including four remnants greater than 1 acre in size. Basic mesic rare plan communities are located primarily on steep slopes, and the final design of Alternative 2-Proposed Action would avoid these areas.

The following paragraphs describe the specific benefits and adverse effects associated with each of the three restoration approaches that would be employed to reestablish floodplain connectivity within the Project Area, based on site-specific conditions.

Implementing the P1-floodplain reconnection approach would raise the elevation of the streambed to reconnect it to the historic floodplain, resulting in a wet meadow environment.

Over the long-term, this could result in an increase in wetland habitat and, at the landscape level, could increase the diversity of habitats. In the short-term, some upland species of trees may die, and could be replaced by tree species adapted to wetland environments. Mortality of upland species of trees would create "snags" that are beneficial for raptors, cavity nesting birds, and other wildlife. Mortality of mature upland stands as a result of transition to wet meadow habitat would open gaps in the forest canopy, allowing sunlight to reach the forest floor. Creation of such forest gaps has the potential to increase both vertical and horizontal complexity and overall botanical diversity through establishment of lower successional environments in the forest landscape. In the short- to mid-term, creation of forest gaps introduces the potential for highly competitive NNIS to become established on these sites, as discussed in detail below.

Implementing the P2-floodplain excavation and P3-floodplain benches approaches would result in the excavation and removal of existing native hardwood floodplain trees and associated perennial and shrub vegetation to the level of the stream channel; however, the effect would be much less in areas where P3-floodplain benches are created. Some of the associated tree stands are more than 100 years old, and most are more than 80 years old and have well-established late successional forest communities. The loss of mature hardwood forest stands would be short-term, as the reestablished (excavated) floodplain would be managed to promote the establishment of a desired vegetative community of native floodplain forest. The P2-floodplain excavation approach would involve significant removal of existing vegetation; therefore, the Forest Service would implement a planting plan on disturbed sites to promote establishment of the desired vegetative condition (native floodplain bottomland forest) on excavated floodplains.

Non-Native Invasive Species

Implementation of Alternative 2-Proposed Action has the potential to result in both direct and indirect effects related to NNIS. Fill dirt excavated from borrow areas and used to raise the streambed elevation on P1-floodplain reconnection sites could contain NNIS plant material or seeds, resulting in a direct introduction of NNIS. Similarly, NNIS plant materials or seeds could potentially be transported throughout the Project Area, regardless of stream restoration approach, by contaminated construction equipment. The potential for the latter is expected to be minimal, as standard contract provisions for the cleaning of equipment would be implemented to avoid introduction or spread of NNIS.

As previously noted relative to the various restoration approaches, large openings and soil disturbance associated with restoration activities would increase the opportunities for establishment and spread of NNIS, including potential recolonization by loblolly pine. This potential would be mitigated for by the Forest Service's proposed mitigation (Chapter 2) to pre-treat known populations prior to construction activities, followed by long-term monitoring (perhaps for 10 years after construction) and implementation of appropriate NNIS removal and treatment measures, including periodic removal of loblolly pine, as necessary.

The connected actions include excavation of soil from borrow areas and creation of temporary roads and bridges, which would result in short-term removal of vegetation. Some temporary roads and bridges would remain only for the period of construction, whereas

others could remain on the forest landscape for up to 10 years to facilitate post-construction monitoring and maintenance. In addition to the short-term removal of vegetation, creation of these areas would present opportunities for establishment and spread of NNIS. These areas would be included in the long-term NNIS monitoring discussed previously, and appropriate NNIS control and removal measures would be implemented as needed (Chapter 2). Once the borrow and fill areas and temporary roads and bridges are no longer needed, they would be closed, water barred, and re-seeded according to the Forest Service Road Storage and Decommissioning Guidelines, resulting in little to no long term effect.

Excavation associated with the P2-floodplain excavation and P3-floodplain benches restoration approaches, creation of borrow areas, and temporary roads and bridges would result in removal of some merchantable trees; however, the numbers would be relatively small compared to the overall landscape area.

Forest Plan Amendment for Vegetation

A Project-specific Forest Plan amendment would be required for stream restoration activities. The changes are needed to accomplish the purpose and need as described in this Final EIS. Table 3-15 lists the current Forest Plan standard and the proposed changes.

TABLE 3-15: PROPOSED CHANGES TO FOREST PLAN STANDARDS

Current Forest Plan Standard	Proposed Changes*
FW-24: In the piedmont, hardwood inclusions (1/2 acre in size or larger) in pine stands dominated by hard and soft mast producing trees (i.e., oaks, hickories, walnut, black gum, black cherry, persimmon) will be retained.	Minimal removal of hardwood inclusions (1/2 acre in size or larger) would be permitted to accomplish stream restoration work.
FW-33: Existing old growth as defined in "Old Growth Guidance for the Southern Region," when encountered, will be managed to protect the old growth characteristics.	Minimal removal of trees with old growth characteristics would be permitted to accomplish stream restoration work.
FW-37: Healthy (full crowns and free of littleleaf disease) shortleaf pine will not be cut on the piedmont during vegetation management activities in order to maintain future restoration opportunities. Exceptions may be made where needed to provide for public safety, protection of private resources, or insect and disease control, or thinning.	Minimal removal of shortleaf pine would be permitted to accomplish stream restoration work.
9.F.-2: Rare communities are protected from detrimental effects caused by management actions. An exception may be made for beaver ponds on a case-by-case basis where conflicts with aquatic PETS, trout or safety, health, and infrastructure (roads, buildings, culverts, developed sites) are known to occur. Management activities occur within rare communities only where maintained or restoration of rare community composition, structure, or function is needed.	Minimal removal of rare communities would be permitted to accomplish stream restoration work.

*Note: Specific to this Project only

Effects of plan amendment changes are described in direct, indirect and cumulative effects of Alternative 2-Proposed Action. Vegetation impacts to hardwood inclusions, trees with old growth characteristics, healthy shortleaf pine and rare communities would be reduced by following Forest Plan standards including BMPs and site-specific mitigation measures. Minimal impacts are expected in upland areas that contain hardwood inclusions and healthy shortleaf pine. Approximately 663 acres are available to be considered in Project design but only between 70 and 100 acres would most likely be needed to serve as staging areas for equipment or as soil borrow and disposal areas. Most of the areas are dominated by loblolly pine. In addition, these disturbed areas are likely to be scattered over the Project Area to limit dirt hauling on system roads and to be immediately adjacent to stream restoration activities to increase economic efficiency.

Approximate 20 acres of land that contains trees with old growth characteristics are likely to be affected. These trees typically occur along the stream bank or the adjacent riparian area of streams to be restored. In addition, in streams where P1-floodplain reconnection restoration is planned, there would be minimal impact to stream banks as the old channel is filled in and the elevation is raised. This would help to minimize the impacts on these types of trees.

The number of acres likely to be impacted that contain rare communities has been minimized by Project design. Intersecting known communities with actual stream restoration, places most rare communities on the edge of the proposed restoration activities. It is likely that direct effects would be minimal, however, there could be indirect effects associated with increased sunlight and changes in soil moisture conditions that may adversely affect some individual rare species or communities.

3.7.5 *Cumulative Effects of Alternative 2-Proposed Action*

As noted above relative to direct and indirect effects, implementation of Alternative 2-Proposed Action would result in varying levels of vegetation removal, including removal of significant areas of mature forest, on the stream reaches proposed for restoration, as well as on the soil borrow and temporary road sites. Along with other forest clearing activities likely occurring in the Piedmont region, such as residential and commercial development and timber harvesting, implementation of Alternative 2-Proposed Action has the potential to cumulatively result in reductions in mature forest cover within the Piedmont region. However, these reductions would be insignificant at the landscape level and would be short-term in nature.

Implementation of Alternative 2-Proposed Action would result in some cumulative impacts to potential old growth forests. As previously noted, some forests containing old growth characteristics would be minimally impacted during excavation for restoration activities. Riparian areas dominated by old, intact river floodplain forest are relatively common on the Sumter National Forest, but much less common on private lands across the piedmont of the Carolinas and Georgia, where they are threatened both by development and agricultural practices.

Implementation of Alternative 2-Proposed Action is expected to result in minimal cumulative effects to rare communities (namely basic mesic forest). Field investigations by Atkins (2013a) reveled four basic mesic community remnants over 1 acre is size (5.74 acres) that would be subject to the rare community forest prescription. These stands are located primarily on steep slopes, and the final design of Alternative 2-Proposed Action would avoid these areas. High quality basic mesic plant communities are very uncommon on private and public lands across the piedmont of the Carolinas and Georgia, where they are threatened by development and agricultural practices.

Finally, implementation of Alternative 2-Proposed Action would result in increased opportunities for NNIS to become established through both direct and indirect means, as discussed above including some cumulative effects. River floodplain forest are particularly vulnerable to the introduction and spread of non-native invasive plant species, particularly when disturbed. These impacts would be largely mitigated on National Forest lands by the

extensive monitoring, pre-and post-treatment and equipment BMPs proposed for the Project Area. Non-native invasive plant species are expected to increase across the landscape on private lands in the future.

3.8 PROPOSED, ENDANGERED, THREATENED AND SENSITIVE SPECIES

3.8.1 *Affected Environment*

The USFWS lists four species that are federally protected or that are candidates for such protection as occurring in Chester County, South Carolina (Table 3-16; USFWS 2013a as cited in Atkins 2014c). Of the bird species, Atkins (2014c) notes that suitable habitat exists in the Project Area for the bald eagle, but not for the red-cockaded woodpecker (*Picoides borealis*). Similarly, the Carolina heelsplitter (*Lasmigona decorate*) is known historically only from the Catawba, Pee Dee, and Saluda drainages in South Carolina; therefore, it is not expected to occur in the Project Area. Eight populations of Georgia aster (*Symphyotrichhum georgianum*) are known to occur in the Sumter National Forest; one of these is in Study Area 1 (Atkins 2014c; USDA 2010a as cited in Atkins 2014c).

TABLE 3-16: FEDERALLY THREATENED, ENDANGERED, AND CANDIDATE SPECIES FOR CHESTER COUNTY, SC

Common Name	Scientific Name	Status[1]
Bald eagle	*Haliaeetus leucocephalus*	BGEPA
Red-cockaded woodpecker	*Picoides borealis*	E
Carolina heelsplitter	*Lasmigona decorate*	E
Georgia aster	*Symphyotrichhum georgianum*	C

Source: USFWS 2013a as cited in Atkins 2014c
1BGEPA – Federally protected under the Bald and Golden Eagle Protection Act
E – Federally listed as endangered under the Endangered Species Act
C – A candidate for federal listing as threatened or endangered

The Forest Service also tracks an expanded list of what it classifies as proposed, endangered, threatened, and sensitive (PETS) species. In addition to species that are federally protected or proposed for federal protection, PETS include sensitive species that the Forest Service Regional Forester has administratively designated based on the recommendations of Forest Service biologists, who consulted with State Heritage Programs, The Nature Conservancy, and local species experts (Atkins 2014c). Atkins (2014c) evaluated a list of 49 PETS species for the Sumter National Forest (Appendix A in Atkins 2014 c) and conducted field surveys for 13 species that were either confirmed as occurring or were identified through literature review to have potential habitat in the Project Area.

Georgia aster and bald eagle were the only PETS species observed during field survey by Atkins (2014 c); however, Atkins (2014c) concluded that habitat for Piedmont aster (*Eurybia mirabilis*), lanceleaf trillium (*Trillium lancifolium*), and nodding trillium (*Trillium rugelii*) is present in riparian areas, and habitat for Georgia aster, indigo bush (*Amorpha schwerinii*),

and sweet pinesap (*Monotropsis odorata*) is present in upland areas. Marginal foraging habitat for wood storks (*Mycteria americana*) was noted along larger streams, such as Clarks Creek. Potential impacts of the Project on these eight species were further evaluated in the Forest Service Final Biological Assessment/Biological Evaluation (BA/BE), which is included as Appendix B and is summarized below. Federal status, habitat requirements, and status in the Project Area of the eight species evaluated in the Final BA/BE is presented below in Table 3-17.

TABLE 3-17: PETS SPECIES KNOWN TO OCCUR OR HAVE POTENTIAL HABITAT IN ENOREE RANGER DISTRICT, SUMTER NATIONAL FOREST

Species	Status	Habitat	Observed[1]	Habitat[2]	Range[3]
Birds					
bald eagle *Haliaeetus leucocephalus*	Sensitive (also federally listed under BGEPA)	Perennial rivers and lakes, nesting in dominant or co-dominant pines 3 km or less from open water	Known occurrence	+	P, M
wood stork *Mycteria americana*	Federally Endangered	Known to forage in freshwater wetlands on both Enoree and Long Cane Ranger Districts	--	+	CP, P
Plants					
Georgia aster *Symphyotrichum georgianum*	Sensitive; Federal Candidate	Open stands or rights-of-way with grassy understories; Piedmont and lower elevations in mountains	Known occurrences	+	P, M
indigo bush *Amorpha schwerinii*	Sensitive	Pine-oak heaths and oak-hickory communities in the Piedmont of SC	--	+	P
lanceleaf trillium *Trillium lancifolium*	Sensitive	Basic mesic forests of the Piedmont	--	+	P
nodding trillium *Trillium rugelii*	Sensitive	Rich wooded slopes over mafic or calcareous rocks	--	+	P, M
Piedmont aster *Eurybia mirabilis*	Sensitive	Nutrient-rich bottomlands and moist slopes, endemic to the NC and SC Piedmont	--	+	P
sweet pinesap *Monotropsis odorata*	Sensitive	Shortleaf pine-oak heaths in the southern Appalachians and Piedmont	--	+	P, M

Source: Atkins 2014c
[1] Observed – Whether or not occurrences of this species have been recorded previously in the Enoree Ranger District.
[2] Habitat: + = Habitat for this species occurs in the Enoree Ranger District
[3] Range: P = Piedmont, M = Mountains, CP = Coastal Plain
[4] Weakley 2012

3.8.2 *Direct and Indirect Effects of Alternative 1-No Action*

There would be no direct effects to the PETS species under Alternative 1-No Action because no activities would take place.

3.8.3 *Cumulative Effects of Alternative 1-No Action*

There may be cumulative effects to PETS species as a result of other forest management activities, such as timber harvesting, prescribed burning, and trail development. The Forest

Service has specific BMPs and standards in the Forest Plan for reducing or avoiding impacts to these species.

3.8.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

BALD EAGLE

Stream restoration activities (P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches) and related activities addressed in the proposed Forest Plan amendment are not likely to directly affect bald eagles using the McCluney Branch Road nest since it is located outside of all stream restoration corridors. Connected actions (road reconstruction and maintenance, the construction of temporary roads, the removal of timber within soil borrow/deposition areas, and soil borrow and deposition activities) and related activities addressed in the proposed Forest Plan amendment would likely disturb nesting bald eagles, potentially affecting foraging behavior and reproductive success. To avoid adverse direct effects, Forest Plan Standard FW-28[3] and the design criterion (Section 2.4.5 #1-2; Chapter 2) would be followed. If other nests are found before or during Project implementation, then Forest Plan Standard FW-28 and the design criterion (Section 2.4.5 #1-2; Chapter 2) would apply.

The existing bald eagle nest on McCluney Branch Road would not be affected by Project activities. Forest Plan Standard FW-28 and the design criterion (Section 2.4.5 #1-2) would protect the nest and surrounding canopy from disturbance or modification; however, tree removal within the stream restoration corridors and within the soil borrow/deposition areas would affect potential nest and roost sites. Considering the amount of available habitat within the surrounding areas, any loss of potential nest or roost sites is insignificant and would not have an adverse indirect effect on bald eagles.

GEORGIA ASTER

Stream restoration activities (P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches) and related activities addressed in the proposed Forest Plan amendment are not likely to affect Georgia aster because no plants occur within any of the stream restoration corridors. However, individual plants (and in one case the whole occurrence [Wade Road]) could be disturbed or destroyed by connected actions (road reconstruction and maintenance, temporary road construction, timber removal, and soil borrow/deposition activities) and related activities addressed in the proposed Forest Plan amendment. In order to avoid direct effects to Georgia aster, design criteria #2-6 would be followed (refer to Final BA/BE).

Georgia aster habitat would not likely be affected within stream restoration corridors. These areas include predominantly aquatic habitats, streambanks, and floodplains, which are not

[3] Forest Plan Standard FW-28 (p. 2-9): "Protection zones are delineated and maintained around all bald eagle nests and communal roost sites, until they are determined to be no longer suitable through coordination with the U.S. Fish and Wildlife Service. The protection zone extends a minimum of 1,500 feet from the nest or roost. Activities that modify the forest canopy within this zone are prohibited. All management activities not associated with bald eagle management and monitoring are prohibited within this zone during periods of use (nesting season is October 1 to June 15; roost use periods are determined through site-specific monitoring). Where controlled by the Forest Service, public access routes into or through this zone are closed during the season of use, unless they are major arterial roads."

suitable habitat for Georgia aster. Georgia aster habitat could be affected by activities that take place along roadsides or utility rights-of-way, in open woods, or other suitable habitats. In order to avoid adverse effects to habitats that are currently occupied by Georgia aster, design criteria #2-6 would be followed.

INDIGO BUSH, LANCELEAF TRILLIUM, NODDING TRILLIUM, PIEDMONT ASTER, AND SWEET PINESAP

Indigo bush, lanceleaf trillium, nodding trillium, Piedmont aster, and sweet pinesap are not known to occur within or adjacent to the Project Area. There would be no direct effects to these species during the implementation of the Alternative 2-Proposed Action.

Habitat for these species would be adversely affected within stream restoration areas, soil borrow/deposition areas, by the placement of temporary roads, and with the implementation of related activities addressed in the proposed Forest Plan amendment. Existing vegetation would be removed and soils would be disturbed significantly at these sites. It would take several years after Project implementation to have suitable habitats for these species within the Project Area.

WOOD STORK

The Project would not likely have any direct effects on the wood stork. Potential wood stork habitat exists within the Project Area. It is possible that if wood storks were present during Project implementation they would be disturbed and forced to leave the area. Because wood storks are highly mobile avian species, they would disperse to undisturbed areas. Wood storks are likely to return once the disturbance is over and their wetland habitats are restored.

Stream restoration activities (P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches) and related activities addressed in the proposed Forest Plan amendment would result in the immediate but short-term loss of wetland habitats. After streams are restored, the quantity and quality of wood stork habitat would increase, benefiting the species. Connected actions (road reconstruction and maintenance, temporary road construction, timber removal, and soil borrow/deposition activities) and related activities addressed in the proposed Forest Plan amendment are not expected to affect wood stork habitat, because they would occur in places where there are no existing wetlands.

3.8.5 *Cumulative Effects of Alternative 2–Proposed Action*

Other forest management activities that have taken place on the Enoree Ranger District include prescribed burning, timber sales, pre-commercial thinning and release of timber, southern pine beetle control, recreation trail reconstruction and maintenance, seeding of roads, skid trails, firelines, and log decks, road maintenance (grading, brushing, and mowing), and wildlife opening management. Most of these activities are expected to continue in the near future at approximately the same levels. Private lands within or adjacent to the proposed Project areas are made up of timberland, home sites, pastures, and farmland. Intensive timber management activities on private lands, including thinning, regeneration cuts, and road building, have occurred heavily over the past 10 years within some of these areas.

The cumulative effects of the proposed Project in combination with other past, present, and future actions are not anticipated to result in any measurable loss of the evaluated species or their habitats.

3.9 WILDLIFE

3.9.1 *Affected Environment*

Wildlife habitats in the Project Area and the surrounding vicinity are dominated by the mixed hardwood forests typical of the Piedmont region of South Carolina (Section 3.7). This habitat type is characterized by a high degree of structure, including both vertical complexity (height class diversity of vegetation) and microhabitat features such as snags, dead-and-down wood, and forest floors of leaves and woody debris. The mixed hardwood forest cover type typically supports a dense population of small mammals. This may be attributable to the fact that these areas produce substantial amounts of mast (seeds and nuts) that provide valuable forage for a variety of wildlife species (Degraaf and Rudis 1986 as cited in Atkins 2014c).

MANAGEMENT INDICATOR SPECIES

Thirteen wildlife species classified by the Forest Service as MIS have been identified for the Sumter National Forest (Table 3-18). Only 12 species are evaluated in this Final EIS. Black bear (*Ursus americanus*) is considered a mountain species and a viable population does not exist within the Project Area. These species are considered to be indicators of species diversity, and the Forest Service uses them as tools for identifying specialized habitats and creating habitat objectives, standards, and guidelines (Atkins 2014c). Observation data collected from 1994 to 2000 and from 2007 to 2012 at established count stations documented occurrence of 8 of the 12 MIS birds in the Project Area: hooded warbler (*Wilsonia citrina*), scarlet tanager (*Piranga olivacea*), pine warbler (*Dendroica pinus*), Acadian flycatcher (*Empidonax virescens*), prairie warbler (*Dendroica discolor*), field sparrow (*Spizella pusilla*), pileated woodpecker (*Dryocopus pileatus*), and eastern wild turkey. Brown headed nuthatch (*Sitta pusilla*) is thought to be common due to an abundance of suitable habitat. Suitable habitat for Swainson's warbler (*Limnothlypis swainsonii*), and American woodcock (*Scolopax minor*) is available due to an abundance of floodplain sites with cane and/or privet. Bobwhite quail (*Colinus virginianus*) is likely to occur in the Project Area, but it is not thought to be abundant due to the lack of grasslands and fields (Atkins 2014c).

Wildlife resources of the Project Area are considered further in the Proposed, Endangered, Threatened, and Sensitive Resources and Migratory Birds sections of this document (Section 3.8 and 3.10, respectively).

TABLE 3-18: MANAGEMENT INDICATOR SPECIES FOR THE SUMTER NATIONAL FOREST

Management Indicator Species	Associated Forest Community[1]	% Annual Change, Southern Piedmont[2]	% Annual Change, Francis Marion and Sumter National Forests[2]
hooded warbler (*Wilsonia citrina*)	Mesic deciduous forests providing dense understory and mid-story structure	-11.5 (CI -15.4 to -7.3)	-0.6 (CI -2.6 to 1.4)
scarlet tanager (*Piranga olivacea*)	Oak forests	3.7 (CI -2.1 to 9.8)	-1.0 (CI -3.8 to 1.8)
pine warbler (*Dendroica pinus*)	Pine forests and pine-dominated pine-oak forests	-4.2 (CI -7.0 to -1.3)	-0.2 (CI -2.2 to 1.9)
Acadian flycatcher (*Empidonax virescens*)	Riparian forests	2.2 (CI -1.6 to 6.2)	-1.2 (CI -3.5 to 1.1)
brown-headed nuthatch (*Sitta pusilla*)	Mid and late successional pine and pine/oak forest	2.7 (CI -3.5 to 9.3)	5.4 (CI 2.8 to 8.0)
prairie warbler (*Dendroica discolor*)	Early successional forests	-8.9 (CI -13.6 to -4.1)	-8.1 (CI -11.1 to -5.0)
Swainson's warbler (*Limnothlypis swainsonii*)	Canebrakes and other early successional riparian habitats	Not available (species occurred on fewer than six points)	8.2 (CI 1.1 to 15.8)
field sparrow (*Spizella pusilla*)	Woodland/grassland/savannah habitats	-16.6 (CI -25.0 to -7.3)	-19.1 (CI -23.0 to -15.0)
American woodcock (*Scolopax minor*)	Early successional riparian habitats	Not recorded in the Southern Piedmont or the Francis Marion or Sumter National Forest. For the Southern Region: -5.4 (CI -10.5 to 0.0)	
pileated woodpecker (*Dryocopus pileatus*)	Across the forest where snags are abundant.	-7.1 (CI -10.3 to -3.8)	-1.2 (CI -2.7 to 0.2)
bobwhite quail (*Colinus virginianus*)	Early successional habitats such as croplands, grasslands, fallow fields, open pinelands and open mixed pine-hardwood forests that have diverse groundcover vegetation (SCDNR 2006b).	-17.3 (CI -21.7 to -12.8)	-10.0 (CI -12.6 to -7.3)
Eastern wild turkey (*Meleagris gallopavo*)	Woodland margins, sparse brushlands, recent regeneration areas, and open fields; dense pole stands, sapling stands, or extensive woodlands and swamps (SCDNR 2013d).	-2.4 (CI -12.9 to 9.4)	-0.8 (CI -5.8 to 4.4)

Source: Atkins 2014c

1 Habitat information obtained from USDA 2004a (as cited in Atkins 2014c) except where noted.

2 Bird population change data from La Sorte et al. 2007 (as cited in Atkins 2014c) except where noted. Population change data includes confidence interval (CI).

3.9.2 *Direct and Indirect Effects of Alternative 1-No Action*

Management Indicator Species and Other Wildlife Species Associated with Riparian Habitats

Alternative 1-No Action would have no direct effects on any of the MIS because no activities would take place.

Indirect effects would include the consequences of continuing management activities that result in modifications of habitat and ecological conditions that affect food, water, shelter, and other life requirements for a species. There would be no indirect effects to all MIS under the Alterntive 1-No Action alternative.

3.9.3 *Cumulative Effects of Alternative 1-No Action*

Typical ongoing activities on the Enoree Ranger District include timber harvesting, prescribed burning, wildlife habitat improvements and management activities, and road maintenance. Under Alternative 1-No Action alternative, no stream restoration activities would take place, so beneficial effects of the stream restoration would not occur.

3.9.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

While there is always the potential to injure or lose individuals in a wild population from activities designed to restore, enhance, or maintain desired habitat conditions, direct effects on populations of any MIS from Alternative 2-Proposed Action would likely be insignificant. Noise and other disturbance associated with construction activities (filling of the incised stream channel on P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches, as well as soil borrow and fill activities) could temporarily disturb or displace MIS that are present at the time. Individual nests and nestlings of species could be lost due to these activities. This effect is temporal for several reasons: vegetation management activities may or may not occur while nests are active; the duration of Project activities would be limited in locations where active nests are present, and many avian species raise multiple broods or are known to re-nest if disturbed during the nesting season. No measurable decline in reproductive success of MIS is expected to result from any of the proposed activities.

Establishment of wet meadow environments and re-establishment of hydrology to the floodplain would result in significant increases in the quantity and quality of riparian habitats, which would result in long-term increases in habitat for riparian-dwelling MIS species (i.e., acadian flycatcher, American woodcock, Swainson's warbler). Establishment of wet meadow environments could result in an increase in breeding habitat for amphibians, potentially increase foraging habitats for wading birds, and increase habitat for wood ducks and other waterfowl.

The following paragraphs describe the specific benefits and adverse effects associated with each of the three restoration approaches that would be employed to re-establish floodplain connectivity within the Project Area, based on site-specific conditions (See Chapter 2).

Implementing the P1-floodplain reconnection approach would adversely affect amphibians and other slow moving, semi-aquatic species that are unable to disperse from the stream

channel during construction. Those species would be susceptible to being physically buried during filling of the incised stream channel; however, the number of organisms affected would be limited due to the relatively low habitat value of the existing incised streams. No effects would be expected at the population level.

Similarly, the excavation and soil compaction associated with implementing the P2-floodplain excavation and P3-floodplain benches approaches could result in mortality of some burrowing or slow moving terrestrial organisms, such as hibernating toads and snakes. These impacts are expected to affect a relatively small number of organisms due to the small footprint of the construction area compared to the surrounding landscape. Again these effects are not expected to affect wildlife species at the population level.

MIS Associated with Hardwood and Mixed Pine-Hardwood Forests (Hooded Warbler, Scarlet Tanager, Pileated Woodpecker, Eastern Wild Turkey)

In the short-term, removal of mature hardwood and mixed-pine hardwood forest stands during P2-floodplain excavation and construction of P3-floodplain benches would result in some minor reduction and fragmentation of habitat for forest dwelling MIS species (i.e., hooded warbler, scarlet tanager, pileated woodpecker, eastern wild turkey). These impacts are expected to be short-term and would be balanced by the increase in habitat diversity resulting from creating lower successional communities in proximity to the mature forests.

MIS Associated with Pine Forest (Brown-headed Nuthatch, Pine Warbler)

Pine habitats occur on some of the proposed soil borrow and soil disposal areas and temporary road sites of the Project Area; as such, vegetation removal on these sites would result in short-term losses of habitat for brown-headed nuthatch and pine warbler. These impacts would be short-term until soil borrow and soil fill and temporary road areas are closed and restored to native vegetative condition following Project completion.

MIS Associated with Early Successional/Disturbance-dependent Habitats (Prairie Warbler, Field Sparrow, Northern Bobwhite)

Clearing of vegetation on P2-floodplain excavation and P3-floodplain bench sites would result in opening forest gaps of varying sizes. Establishment of lower successional communities on these sites would likely increase habitat for MIS associated with early successional/disturbance-dependent habitats (i.e., prairie warbler, field sparrow, northern bobwhite).

MIS Associated with Riparian Areas (Acadian Flycatcher, American Woodcock, Swainson's Warbler)

Establishment of wet meadow environments on P1-floodplain reconnection sites, as well as re-establishment of hydrology to the floodplain on P2-floodplain excavation sites would likely result in significant increases in the quality and quality of riparian habitats, which would result in long-term increases in habitat for riparian dwelling MIS species.

OTHER WILDLIFE SPECIES

Implementation of Alternative 2-Proposed Action would result in an increase in breeding habitat for amphibians and reptiles through establishment of wet meadow environments on P1-floodplain reconnection sites and potentially vernal pools on P2-floodplain excavation sites. These sites could potentially increase foraging habitats for wading birds and provide habitat for wood ducks and other waterfowl.

There are temporary and short-term adverse effects associated with the construction and connected actions on the wildlife communities. Construction impacts are primarily associated with instream disturbance as a new stream channel and streambank is modified or constructed. In riparian areas, clearing vegetation and soil disturbance would be associated with temporary roads and access to work areas, crossing streams with temporary bridges, and equipment use in and around the existing and proposed stream channel locations. The existing road system would be used to the extent possible but would require some reconstruction, such as applying gravel to existing road surfaces. Frequent maintenance would occur during periods of heavy truck use associated with hauling dirt from borrow and disposal areas, log hauling and movement of heavy equipment. Road use could be restricted immediately after heavy rains to reduce erosion runoff into the streams. Of the 663 acres initially identified as potential soil borrow/spoil disposal areas, only a portion would be disturbed because sufficient areas have been selected to provide options that would limit haul distances from borrow and disposal sites to the Project Area, thereby reducing the short-term and long-term impacts to wildlife and their habitats. Forest standards include the use of BMPs specific to the Forest Service and SCDHEC Erosion and Sediment Control Standards would be employed to limit erosion and sedimentation occurring both pre- and post-construction. Forest Plan standards would include use of water-bars on temporary roads, soil ripping, grading, disking at log landings and equipment staging areas followed by revegetation with grasses and forbs. This would reduce long-term erosion and allow vegetation to re-establish and grow. Temporary roads would be closed and revegetated after restoration work is completed with the intent to return them to a vegetated condition.

Temporary roads could contribute to erosion and sediment in the short term (up to 3 years), but effective erosion control measures would mitigate the effects on soil and water. Closing temporary roads after use would allow the soil building process to begin on the road surface. As soil develops, vegetation would begin to grow. This process allows closed roads to recover to a more natural state over time and have reduced impact of wildlife disturbance and fragmentation.

3.9.5 *Cumulative Effects*

Typical forest management activities in the Project Area include timber harvesting, prescribed burning, wildlife habitat improvements and management activities, trail construction and maintenance, herbicide control of non-desirable species (including NNIS), road maintenance (including culvert repair and replacement), and erosion control practices. In the future, all activities are expected to continue at about the same levels. On privately owned lands, the primary land uses are timber management, farming, and livestock production. Private lands are also used for residential areas and recreation such as hunting.

MIS Associated with Hardwood and Mixed Pine-Hardwood Forest (Hooded Warbler, Scarlet Tanager, Pileated Woodpecker, Eastern Wild Turkey)

According to Forest Service monitoring data from 1992 through 2004, hooded warbler and scarlet tanager populations declined slightly (0.6% and 1.0% annual declines, respectively) on the Francis Marion and Sumter National Forests between 1992-2004 (La Sorte et al. 2007). Hooded warbler primarily use deciduous forests, but also occupy mixed pine-hardwood habitats. Scarlet tanager inhabit large blocks of mature forests, especially where oaks are common. While Alternative 2-Proposed Action would result in some short-term losses of habitat for these species related to removal of mature trees during construction, no long-term cumulative effects are expected, as mature forests become re-established on disturbed sites.

Trend estimates indicate that populations of pileated woodpecker are stable across the southeastern United States. Pileated woodpecker use extensive areas of late successional coniferous and deciduous forest. However, young forests that retain scattered, large, dead trees also provide suitable habitat. This species is versatile in utilizing various forest habitats and adapts well to human habitation. Habitat also exists for pileated woodpecker on private property across the mountains, including in rural and suburban settings. As with the other MIS that occupy mature forests, Alternative 1-Proposed Action would result in some short-term loss of habitat related to vegetation removal. However, no cumulative effects are expected, as long-term habitat conditions are expected to return to a mature forest condition over time.

Populations of wild turkey suffered dramatic declines in the early 1900s. Aggressive stocking programs successfully reintroduced this species to most of its eastern range where populations continue to increase. Wild turkey use upland forests of oaks, hickories and pines as well as bottomland forest. Alternative 2-Proposed Action is expected to result in positive cumulative impacts to this species in the short-term by creating scattered openings dominated by herbaceous cover. In the long term, re-establishing functional floodplains would likely increase both quantity and quality of bottomland hardwood habitats, resulting in a positive cumulative impact for eastern wild turkey.

MIS Associated with Late Successional Pine (Brown-Headed Nuthatch, Pine Warbler)

Brown-headed nuthatch populations increased 5.4% annually on the Forest from 1992 to 2004. Pine warbler populations have declined slightly (0.2% annual decline) over the same period of time (La Sorte et al. 2007). The population stability of these MIS is a reflection of the quantity and quality of available habitats on the Sumter National Forest. Implementing Alternative 2-Proposed Action would not likely result in cumulative effects to these species due to the limited spatial extent of pine habitats that will be affected (only on soil borrow and temporary road sites) and the short-term nature of the effects.

MIS Associated with Early Successional/Disturbance-dependent Habitats (Prairie Warbler, Field Sparrow, Northern Bobwhite)

As previously noted, implementation of Alternative 2-Proposed Action would, in the short-term, result in opening of forest gaps of varying sizes, which should in-turn result in an

increase in habitat for MIS associated with early successional/disturbance-dependent habitats. These effects would represent a positive cumulative impact to these species.

MIS Associated with Riparian Areas (Acadian Flycatcher, American Woodcock, Swainson's Warbler)

Reconnection of floodplain hydrology and establishment of wet meadow environments associated Alternative 2-Proposed Action are expected to result in long-term habitat improvements for these species. These positive effects should aid in balancing other negative cumulative effects that are likely occurring in the region, such as loss of riparian habitat due to clearing for residential, logging and agricultural development.

3.10 NEOTROPICAL MIGRATORY BIRDS

The Forest Service is recognized as a national and international leader in conservation of natural resources and plays a pivotal role in the conservation of migratory birds and their habitats. Within the National Forest System, conservation of migratory birds focuses on providing diverse habitat at multiple spatial scales and ensuring that bird conservation is addressed when planning for other land management activities.

The Enoree Ranger District is associated with Bird Conservation Region (BCR) 29-Southern Piedmont. The 47-million-acre BCR 29 is a transitional area between the Coastal Plain and the Appalachian Mountains that is dominated by pine and mixed pine-hardwood forests with some interior wetlands, reservoirs, and riverine systems. This BCR provides breeding habitat for 140 bird species, many of which have experienced steep population declines in recent decades.

Atkins (2014c) conducted a desktop analysis of migratory bird species likely to occur in the Project Area. This assessment involved reviewing priority migratory bird species for BCR 29 to identify those also listed as Partners in Flight Species of Continental Importance for the United States and Canada (Rich et al. 2004) and that have potential habitat in the Project Area. Habitat for migratory bird species was evaluated based on the species composition and structure of the plant community, vegetation successional stage, presence of riparian habitat, and other factors (Atkins 2014c).

The Project Area encompasses potential habitat for 21 priority migratory species (Atkins 2014c) (Table 3-19). Table 3-19 indicates their habitat preferences, breeding status, and whether or not Atkins (2013b) identified observations of these species in the Project Area. Based on Forest Service point count data summarized by Atkins (2014c), the most commonly observed priority species in the Project Area are Carolina wren (*Thryothorus ludovicianus*; 54 observations), wood thrush (*Hylocichla mustelina*; 37 observations), indigo bunting (*Passerina cyanea*; 28 observations), prairie warbler (*Dendroica discolor*; 17 observations), and pine warbler (*Dendrocia pinus*; 17 observations), followed by lesser numbers of other species (Table 3-19). Based on the dominant habitat types occurring in the Project Area (Section 3.7), stable populations of priority migratory bird species that use woodlands, forests, and riparian habitats are more likely to occur within the Project Area than populations of species that depend on early successional habitats, like grasslands and old fields (Atkins 2014c).

Although none of the species identified in Table 3-19 are federally listed as threatened or endangered or are candidates for such listing, all are listed as conservation priority species either by the North American Bird Conservation Initiative (NABCI 2013) or in the SCDNR's Comprehensive Wildlife Conservation Strategy (SCDNR 2006 as cited in Atkins 2014c). Table 3-19 summarizes the NABCI (2013 as cited in Atkins 2014c) and (SCNDR 2006 as cited in Atkins 2014c) priority statuses, as well as habitat preferences, breeding status, and observations of priority species identified by Atkins (2013b).

TABLE 3-19: PRIORITY MIGRATORY BIRD SPECIES LIKELY TO OCCUR WITHIN THE PROJECT AREA SPECIES

Migratory Bird Species	NABCI Priority[1]	SCDNR Priority[2]	Habitat	Breeding[3]	Observed[4]
brown-headed nuthatch (*Sitta pusilla*)	Highest	Highest	Mature pine or mixed pine-hardwood forests	Probable	No
prairie warbler (*Dendroica discolor*)	Highest	Highest	Woodland, savanna, grassland	Probable	Yes (17)
Carolina wren (*Thryothorus ludovicianus*)	High		Forests with well-developed forest understories	Probable	Yes (54)
chuck-will's-widow (*Caprimulgus carolinensis*)	High		Pine/hardwood forest types, especially near openings	Possible	Yes (1)
Eastern towhee (*Pipilo erythrophthalmus*)	High		Forests with well-developed forest understories	Probable	Yes (11)
Eastern wood-pewee (*Contopus virens*)	High	Highest	Mature pine or mixed pine-hardwood forests	Probable	Yes (2)
indigo bunting (*Passerina cyanea*)	High		Woodland, savanna, grassland	Probable	Yes (28)
Kentucky warbler (*Oporornis formosus*)	High	Highest	Mixed pine-hardwood forest	Probable	No
pine warbler (*Dendroica pinus*)	High		Mature pine or mixed pine-hardwood forests	Probable	Yes (17)
Swainson's Warbler (*Limnothlypis swainsonii*)	High	Highest	Bottomland hardwoods with cane breaks	No data	No
white-throated sparrow (*Zonotrichia albicollis*)	High		Forests with well-developed forest understories	No data	No
wood thrush (*Hylocichla mustelina*)	High	Highest	Mixed pine-hardwood forest	Probable	Yes (37)
yellow-throated vireo (*Vireo flavifrons*)	High		Mature hardwoods	Confirmed	Yes (9)

Migratory Bird Species	NABCI Priority[1]	SCDNR Priority[2]	Habitat	Breeding[3]	Observed[4]
brown thrasher (*Toxostoma rufum*)	Moderate		Forests with well-developed forest understories	Probable	No
prothonotary warbler (*Protonotaria citrea*)	Moderate		Shrublands, forested wetlands; riparian habitat	No data	Yes (1)
red-headed woodpecker (*Melanerpes erythrocephalus*)	Moderate		Mature pine or mixed pine-hardwood forests	No data	Yes (6)

Source: Atkins 2014c as modified by Kleinschmidt
[1] NABCI Conservation Priority from NABCI (2013), as cited by Atkins (2014a).
[2]SCDNR Conservation Priority from SCDNR (2005).
[3] Breeding information from the South Carolina Breeding Bird Atlas (SCDNR 2010, as cited in Atkins 2014c).
[4] Observed: Yes/No (#) = Number of occurrences documented by the Forest Service bird point count surveys from 1994 to 2000 and 2007 to 2012 (Atkins 2014c).

3.10.1 *Direct and Indirect Effects of Alternative 1-No Action*

Under Alternative 1-No Action, no stream restoration activities would be implemented to accomplish the purpose and need; therefore, there would be no direct and indirect effects on migratory birds or their habitats within the Project Area.

The natural resources and ecological processes within the Project Area would continue at the existing level of human influence. The characteristics of the forest environment would be affected primarily by natural disturbances such as insects, disease, and weather events. Custodial management of recreation areas, roads, prescribed burning and other projects already approved under prior decisions would continue under Alternative 1-No Action.

Priority migratory bird species listed in Table 3-19 would continue to use what little habitat is available for them in the Project Area under Alternative 1-No Action. Landscape scale habitat creation/restoration would not occur under this alternative. Alternative 1-No Action would not provide any benefits to identified priority migratory bird species.

Habitat conditions for priority migratory bird species would not be affected under Alternative 1-No Action alternative.

3.10.2 *Cumulative Effects of Alternative 1-No Action*

There are other projects being planned and implemented in the Enoree Ranger District and in the Project Area that would continue under Alternative 1-No Action. Projects may include, but not be limited to, timber harvesting, prescribed burning for hazard fuel reduction and wildlife habitat improvement, road maintenance, and recreation trail construction/ maintenance. Ongoing activities have the potential to benefit various species listed in Table 3-19, but not on the scale that the proposed Project seeks to accomplish. With Alternative 1-No Action, no additional activities would take place, so there would be no additional cumulative effects within the Project Area.

3.10.3 *Direct and Indirect Effects of Alternative 2-Proposed Action*

While there is always the potential to injure or lose individuals in a wild population from activities designed to restore, enhance, or maintain desired habitat conditions, direct effects on populations of any migratory bird species from Alternative 2-Proposed Action would be insignificant. Noise and other disturbance associated with construction activities (filling of the incised stream channel on P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches, as well as soil borrow and fill activities) could temporarily disturb or displace migratory birds that are present at the time. Individual nests and nestlings of species could be lost due to these activities. This effect is temporal for several reasons: vegetation management activities may or may not occur while nests are active; the duration of Project activities would be limited in locations where active nests are present, and many avian species raise multiple broods or are known to re-nest if disturbed during the nesting season. No measurable decline in reproductive success of migratory birds is expected to result from any of the proposed activities.

Migratory Birds Associated with Woodland, Savanna, and Grassland Habitats (Prairie Warbler, and Indigo Bunting)

Clearing of vegetation on the P2-floodplain excavation and P3-floodplain benches restoration sites would result in opening of forest gaps of varying sizes. Establishing lower successional communities on these sites would result in an increase in habitat for the prairie warbler and indigo bunting. Within 1 to 2 years after restoration, native grasses and forbs would establish in the understories of these forest stands. Migratory birds would use this habitat during its early stages of development; however, as the stands mature, the quantity and quality of early successional habitat would decline.

Migratory Birds Associated with Mature Pine, Hardwood and Mixed Pine-Hardwood Forests (Brown-Headed Nuthatch, Eastern Wood-Pewee, Kentucky Warbler, Pine Warbler, Red-Headed Woodpecker, Yellow-Throated Vireo)

Implementing Alternative 2-Proposed Action would result in some local fragmentation and loss of habitat for migratory bird species that occupy mature pine, hardwood and mixed pine-hardwood habitat in the short-term. This would be due primarily to the vegetation removal associated with P2-floodplain excavation and, to a lesser degree, on P3-floodplain benches sites and soil borrow areas. These impacts would be minor from the landscape perspective and would result in no population level effects on these species. Impacts on habitat for these species would be mitigated over the long-term as cleared areas regenerate and mature forest is re-established according to Forest Service standards and BMPs.

Migratory Birds Associated with Forests with Well-Developed Forest Understories or Thickets (Brown Thrasher, Carolina Wren, Eastern Towhee, White-Throated Sparrow, Wood Thrush)

Birds associated with forests with well-developed understories or thickets (i.e., brown thrasher, Carolina wren, eastern towhee, white-throated sparrow, wood thrush, brown thrasher) would benefit from most stream restoration activities in Alternative 2-Proposed Action. Clearing of vegetation in the Project Area during construction, in particular on P2-floodplain excavation and P3-floodplain benches sites, would open the forest canopy and increase the development of the understory.

Migratory Birds Associated with Pine/Hardwood Forest Types, Especially Near Open Areas (Chuck-Will's-Widow)

Effects of Alternative 2-Proposed Action would be the same as those effects on migratory birds associated with mature pine or mixed pine-hardwood forests, except that chuck-will's-widow may benefit from the short-term openings associated with clearing of vegetation during construction. There should be no long-term impacts to this species.

Migratory Birds Associated with Riparian Areas (Prothonatory Warbler, Swainson's Warbler)

Establishing wet meadow environments using the P1-floodplain reconnection approach and the P2-floodplain excavation would re-establish hydrology to the floodplain and result in significant increases in the quality and quality of riparian habitats, which would result in long-term increases in habitat for riparian dwelling migratory bird species (i.e., prothonatory warbler, Swainson's warbler).

Construction within the Project Area will result in temporary and short-term adverse effects on the neotropical bird communities. Construction impacts are primarily associated with instream disturbance as a new stream channel and streambank is modified or constructed and will create disturbance for birds in the construction areas. In riparian areas, clearing vegetation and soil disturbance would be associated with temporary roads and access to work areas, crossing streams with temporary bridges, and equipment use in and around the existing and proposed stream channel locations. The existing road system would be used to the extent possible but would require some reconstruction, such as applying gravel to existing road surfaces. Frequent maintenance would occur during periods of heavy truck use associated with hauling dirt from borrow and disposal areas, log hauling and movement of heavy equipment. Of the 663 acres initially identified as potential soil borrow/spoil disposal areas, only a portion would be disturbed because sufficient areas have been selected to provide options that would limit haul distances from borrow and disposal sites to the Project Area, thereby reducing the long-term impacts to bird habitats. Forest standards include the use of BMPs specific to the Forest Service and SCDHEC Erosion and Sediment Control Standards would be employed to limit erosion and sedimentation occurring both pre- and post-construction. Forest Plan standards would include use of water-bars on temporary roads, soil ripping, grading, disking at log landings and equipment staging areas followed by revegetation with grasses and forbs. This would reduce long-term erosion impacts and allow vegetation to re-establish and grow in these disturbed areas. Temporary roads would be closed and revegetated after restoration work is completed with the intent to return them to a vegetated condition. Closing temporary roads after use would allow the revegetation process to begin on the road surface. This would allow closed roads to recover to a more natural state as quickly as possible and reduce any long-term impacts to the bird community.

3.10.4 *Cumulative Effects of Alternative 2-Proposed Action*

Habitats for most migratory birds, except species that use woodland, savanna, and grassland habitats, are generally remaining stable or increasing on the Sumter National Forest. Birds are monitored annually to assess the presence/absence and frequency of occurrence of species by habitat conditions across the Enoree Ranger District. According to Forest Service monitoring data from 1992 through 2004, a significant number of priority migratory bird

species have experienced population declines on the Francis Marion and Sumter National Forest (La Sorte et al. 2007). In general, the negative population trends for most species listed in Table 3-19 reflect the long-term population declines of songbirds across the eastern United States. Avian researchers have documented decreasing population trends among migratory and resident song birds for decades (Faaborg and Arendt 1992, Gauthreaux 1992, Sauer and Droege 1992, Robbins et al. 1989). Most population declines are attributed to loss and fragmentation of breeding, migratory stop-over, and wintering habitats.

As stated in the analysis of indirect effects, stream restoration activities would result in short-term habitat improvements for priority migratory birds that use early successional habitats; habitat improvements for priority migratory birds that use forests with well-developed understories or thickets; long-term habitat improvements for priority migratory birds that use riparian areas; and short-term loss of habitat for species associated with mature forests. Although implementing Alternative 2-Proposed Action may affect the population status of these species locally, restoration activities are not expected to affect range-wide trends in their populations.

3.11 AQUATIC COMMUNITIES

3.11.1 *Affected Environment*

The Project Area encompasses streams in the watersheds of Clarks Creek, Little Turkey Creek, McCluney Branch, and the unnamed tributary to Clarks Creek. These watersheds are components of the lower Broad River, which has been assigned a freshwaters (Class FW) usage classification (SCDHEC 2008 as cited in Atkins 2014e). Aquatic habitat inventories have been conducted throughout these watersheds and serve as management indicators for use in monitoring and evaluating watershed conditions, documenting baseline conditions, and identifying stream impairments. Warm water aquatic communities occur throughout the Project Area. These aquatic communities include fish, crayfish, aquatic insects, and mollusks. Fish surveys have been conducted in various streams across the Enoree Ranger District (NCDENR 2006). The Catena Group conducted fish community studies within the region in 2012 and 2013 with assistance from the Forest Service (as cited in Atkins 2014e). Atkins (2014e) conducted other biological surveys in the Enoree Ranger District, including aquatic insects at 37 stations, mussels at 27 stations, and crayfish at 44 stations. The USDA conducted a crayfish survey at a station in the unnamed tributary to Clarks Creek in 2003 (USDA 2005 as cited in Atkins 2014e). Table 3-20 lists fish species that have been collected in or adjacent to the Project Area during surveys in 2012 and 2013 (Atkins 2014e).

TABLE 3-20: FISH SPECIES COLLECTED IN SUMTER NATIONAL FOREST

Family	Scientific Name	Common Name	State Conservation Priority
Catostomidae	*Catostomus commersoni*	white sucker	
	Erymizon oblongus	creek chubsucker	
Centrarchidae	*Centrarchus macropterus*	flier	
	Lepomis auritus	redbreast sunfish	
	Lepomis cyanellus	green sunfish	
	Lepomis gibbosus	pumpkinseed	
	Lepomis gulosus	warmouth	
	Lepomis machochirus	bluegill	
	Lepomis microlophus	redear sunfish	
	Micropterus salmoides	largemouth bass	
Cyprinidae	*Clinostomus funduloides*	rosyside dace	
	Cyprinella chloristia	greenfin shiner	Moderate
	Cyprinella nivea	whitefin shiner	
	Hybopsis hypsinotus	highback chub	Moderate
	Nocomis leptocephalus	bluehead chub	
	Notemigonus crysoleucas	golden shiner	
	Notropis chlorocephalus	greenhead shiner	High
	Notropis hudsonius	spottail shiner	
	Semotilus atromaculatus	creek chub	
Ictaluridae	*Ameiurus brunneus*	snail bullhead	Moderate
	Ameiurus natalis	yellow bullhead	
Percidae	*Etheostoma collis*	Carolina darter	High
	Etheostoma olmstedi	tessellated darter	
Poeciliidae	*Gambusia holbrooki*	eastern mosquitofish	

Source: Atkins 2014e

Atkins (2014e) collected and identified 20 fish species representing 6 families in Study Area 1 compared to 21 fish species representing 6 families from 10 additional sites located outside of the study area. Within Study Area 1, the headwaters of the unnamed tributary to Clarks Creek and lower Clarks Creek had the greatest species richness (13) and abundance (193). Upper Little Turkey Creek and the unnamed tributary to Clarks Creek had the fewest species (2), and the unnamed tributary to Clarks Creek had the fewest individuals (4). Average species richness and fish abundance within Study Area 1 were 6.6 and 106, respectively, compared to the additional sites, where species richness and fish abundance average were 7.14 and 115, respectively.

No federal or state threatened or endangered fish species or candidate species were collected; however, 5 collected species have state conservation priority as designated by the SCDNR, Comprehensive Wildlife Conservation Strategy (SCDNR 2005 as cited in Atkins 2014e). The species are listed as conservation concerns to maintain diversity in South Carolina waters, and their degree of priority for conservation is classified as moderate, high, or highest.

Highback chub, a species designated as pollution intolerant by North Carolina Department of Environment and Natural Resources (NCDENR [2012]), was collected at sites with diverse habitat types and substrates that were rated as high in overall quality and stability (Atkins 2014e). The remaining species of concern are considered to have intermediate to high pollution tolerance. Only 17 percent of fish species identified at the study sites are rated as intolerant of pollution compared to 33 percent of species found at sites outside the study area (Atkins 2014e).

Four mussel species and one crayfish species (Table 3-21) were identified during Atkins' survey; these were restricted to the main channel of the Broad River and Long Branch (Atkins 2014e). The mussel community included one species listed as highest state conservation priority, the Carolina creekshell. This species has a global rank of G2, meaning that it is at high risk for extinction or elimination due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors (NatureServe 2013), and is listed as a species of concern by the American Fisheries Society (AFS) (Williams et al. 1993). Variable crayfish is not a state priority, and the AFS considers the species to be stable (Williams et al. 1993).

TABLE 3-21: MUSSEL AND CRAYFISH SPECIES COLLECTED IN SUMTER NATIONAL FOREST

Scientific Name	Common Name	Conservation Status			
		NatureServe	State	AFS	State Priority
Mussels					
Elliptio angustata	Carolina lance	G4	S3	SC	Moderate
Uniomerus carolinianus	Florida pondhorn	G4	S3	CS	Moderate
Villosa delumbis	Eastern creekshell	G4	-----	CS	Moderate
Villosa vaughaniana	Carolina creekshell	G2	Ex*	SC	Highest
Crayfish					
Cambarus latimanus	variable crayfish	G5	S4?	CS	------
*This species is presumed to be extirpated in SC, but its status needs to be re-evaluated (SCDNR 2006)					

Source: Atkins 2014e

Atkins conducted surveys of aquatic insects at 37 stations in the four watersheds in 2012 and 2013 (Atkins 2014e). Results showed that watersheds with larger drainage areas (Clarks Creek, Little Turkey Creek, and the unnamed tributary to Clarks Creek) had mainstem reaches with perennial flows and good quality benthic habitat. However, McCluney Branch watershed had many channels that lacked flow during summer and fall months, which resulted in habitat fragmentation. Water-filled pools were separated by dry riffle areas, which resulted in lower benthic community abundance and diversity. When compared to reference streams, all surveyed streams had increased channel incisions, which increased shear stress on stream banks and increased siltation of the stream bed. Average Ephemeroptera,

Plecoptera, and Trichoptera (EPT) taxa richness, total number of taxa, and bioclassification scores were lower as well. The EPT taxa are highly intolerant of pollution; therefore, they are used as water quality indicators. When EPT taxa are present, water quality is rated higher than when these taxa are absent.

3.11.2 *Direct and Indirect Effects of Alternative 1-No Action*

The existing conditions indicate that streams within the Project Area have degraded hydraulic, geomorphologic, and physicochemical functions (Figure 2-1 Harman, et al. 2012); consequently, the existing aquatic communities have been and would continue to be negatively affected under Alternative 1-No Action.

Hydraulic function has been severely degraded by the widespread channel incision observed throughout the Project Area, which negatively affects floodplain connectivity, flow dynamics, and associated interactions between groundwater and surface water. The degraded stream conditions (e.g., increased bank migration rates, reduced lateral stability, accelerated channel evolution, reduced sediment transport competency and capacity, reduced bed form diversity, and relatively uniform bed material) are indicators that the geomorphologic function has been negatively affected resulted in degraded aquatic habitat. The physical condition of the stream channels has also negatively affected physicochemical stream functions, resulting in poor water quality, higher water temperatures, and reduced nutrient cycling.

Due to the degraded underlying stream functions, the streams within the Project Area are not able to achieve their full potential for biological function. The reduced biological function is indicated by lower species richness and abundance, as well as the prevalence of disturbance-tolerant species in the benthic macroinvertebrate and fish community surveys.

In particular, the steeply incised streams lead to increased rates of erosion (Table 3-3). Increased erosion also contributes to degraded water quality and aquatic habitat. Increased levels of sediment accumulation adversely affect macroinvertebrate and fish habitat, which also decreases species diversity and abundance within the stream. Highly incised streams also experience high flushing rates during storms because they are not connected to the floodplain. These high flushing flows can displace fish, disrupt reproduction cycles, and cause extended periods of increased turbidity, resulting in chronic physical effects on the aquatic community. Incised streams also reduce the water table within the valley and can result in a reduced overall stream yield during low-flow periods of the year.

3.11.3 *Cumulative Effects of Alternative 1-No Action*

The current aquatic habitats are impacted and unstable, but could recover to equilibrium over several decades; therefore, the cumulative effects of Alternative 1-No Action are expected to be minimal to the local aquatic communities. Other forest management activities on the Enoree Ranger District include prescribed burning, timber sales, pre-commercial thinning and release of timber, southern pine beetle control, recreation trail reconstruction and maintenance, seeding of roads, skid trails, firelines, and log decks, road maintenance (grading, brushing, and mowing), and wildlife opening management. Most of these activities are expected to continue in the near future at approximately the same levels. Private lands

within or adjacent to the proposed Project Area are made up of timberland, home sites, pastures, and farmland. Intensive timber management activities on private lands, including thinning, regeneration cuts, and road building, have occurred heavily over the past 10 years within some of these areas. The cumulative effects of the current activities in combination with other past, present, and future actions are not anticipated to result in any additional measurable loss of the evaluated species or their habitats.

3.11.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

Alternative 2-Proposed Action involves landscape-scale stream restoration on four watersheds within Chester County, South Carolina, that would result in functional lift for both hydraulic and geomorphologic function throughout the Project Area. Improving these lower-level functions would likely lead to improved habitat conditions and biological function (e.g., greater species richness and abundance, fewer degraded habitat tolerant organisms, and fewer effects on reproduction and recruitment).

Implementing Alternative 2-Proposed Action would benefit the aquatic communities within the Project Area by increasing quality and diversity of in-stream habitat, stabilizing and expanding riparian habitat areas, and reconnecting streams with their floodplains. Instream habitat benefits would include increased diversity of water depth and velocity (pool, riffle and run habitat types), and increased substrate complexity (sand, gravel, and cobble), which would enhance species diversity and support multiple benthic life stages. Improving riparian areas would enhance habitat for aquatic, semi-aquatic, and terrestrial fauna that depend on functional stream corridors. Reconnecting streams with floodplains would alleviate erosion of streambanks, and support improved nutrient cycling, carbon storage, floodplain hydrology, and floodplain forests.

The fish and insect communities within the study area are typical warm water communities comparable to other aquatic communities adjacent to the Project Area. Restoration activities will have an immediate negative impact on the aquatic communities during construction and may extirpate most, if not all of the aquatic community; however, the current community is dominated by pollution tolerant species typically associated with degraded aquatic habitat dominated by accumulations of silt and sediment in the stream. Because each of the restoration techniques will significantly reduce bank erosion and stabilize stream habitats and littoral zones, the long-term resulting aquatic habitats should improve after construction is completed. The resulting functional lift is anticipated to result in stable pool, riffle, and run habitats in each of the restored streams. It is difficult to predict the total number of species or densities of aquatic organisms that will eventually repopulate the restored streams; however, each stream is expected to repopulate via its connection with the Broad River downstream and should support the current and/or additional species. With stable habitats (pools, riffles, runs, littoral zones, and streambanks) extending the entire length of the streams, overall densities of aquatic organisms should also increase over time until a new equilibrium is established.

The following paragraphs describe the specific benefits and adverse effects associated with each of the three restoration approaches that would be employed to reestablish floodplain connectivity within the Project Area, based on site-specific conditions (Chapter 2).

The higher streambed elevation associated with the P1-floodplain reconnection approach would reestablish the stream connection with the existing forested valley bottom, provide a stable stream channel, increase aquatic habitat diversity (increase in riffle and run habitat), and provide greater opportunity for nutrient exchange. Reconnection to the floodplain would increase the habitat available for semi-aquatic species and their ability to move back and forth from the stream to the littoral zone for resting, feeding, and reproducing. Existing coarse substrate, covered by fill material when raising the streambed, would be replaced with constructed riffles.

In headwaters that have very little contributing drainage area, the stream form may be best represented by a stream/wetland/wet meadow complex rather than a single, defined channel. This would enhance or create a habitat type that is very limited in the current stream corridors. These areas should significantly increase habitats for semi-aquatic species of reptiles (snakes and turtles) and amphibians (salamanders, newts, and frogs). Initial construction could completely extirpate the existing populations of fish and aquatic macroinvertebrates, but these should rebound as the stream stabilizes and is reconnected with the Broad River.

The P2-floodplain excavation approach would create a new floodplain near the current bankfull elevation, provide a stable stream channel, and increase habitat diversity. The floodplain excavation approach would have greater short-term adverse effects than the P1-floodplain reconnection or the P3-floodplain benches approaches. The stream corridor would be totally reconstructed using large woody material and, in some instances, original coarse substrate material (boulders/cobble) could be reused in the reconstruction. Excavation of the floodplain would disturb the widest area along the streams of the three approaches, potentially leading to the short-term loss of vegetation in the excavated floodplain, a decrease in recruitment of large wood and leaf litter, and an increase in stream temperatures due to a more open canopy. Loss of riparian vegetation could decrease the food base and the instream habitat complexity during construction. The loss of riparian vegetation is expected to be severe during construction but would be revegetated over several years as each stream segment is restored and the equipment is moved from the area of impact. Construction is expected to affect populations of fish, reptile, amphibian, and macroinvertebrates significantly. In some cases, construction would extirpate the populations until the stream bed and banks have stabilized and the stream is reconnected with the Broad River.

The P3-floodplainbenches approach would create small benches near the current bankfull elevation, provide a stable stream channel, and increase habitat diversity. This approach is designed to address problem areas of the stream that are not functioning and leave areas alone that do not require intervention. Creating floodplain benches would involve saving some existing coarse substrates in the channel, minimizing exposed bare soils, and saving many trees located along the bank; however, bankfull stress may be greater than with the other two approaches because of the limited width of the floodplain, and additional instream log/rock structures may be needed to stabilize the stream at high flows. Construction using the P3-floodplain benches approach is expected to have the least adverse effect of the three approaches on populations of fish, reptiles, amphibian, and macroinvertebrates. Creating

P3-floodplain benches would not extirpate the stream-dependent organisms because, in some cases, organisms could retreat into other stream segments during construction of the benches.

The overall approach of stream restoration design is to mimic local examples of streams that are functioning well. Locally observed “reference” streams would be used for Alternative 2-Proposed Action. As such, the restored streams would be similar in appearance to reference streams in the region. To achieve this effect, designs would incorporate logs, root wads, and large gravel and rock salvaged from within the Project Area for the construction of instream structures. Stream bed substrates would be designed and constructed with additional coarse material, as needed, to maintain bed form and bed roughness-this includes constructing riffles and gravel bars with coarse material.

Woody vegetation is a key design component for bank stabilization in stream restoration designs. Riparian trees and shrubs may be salvaged from nearby locations, creating pockets of vernal pools, and transplanted in mass along streambanks to establish a root network capable of stabilizing the banks. Other practices, such as planting live stakes and native species from nursery stock also promote rapid streambank stabilization and regeneration of riparian and floodplain communities. Active management of these species over time could accelerate plant community succession in these areas to achieve mature vegetative communities more quickly than through natural succession.

Post-construction monitoring would include monitoring stream channel morphology, conducting rapid biological assessments of habitat, benthic macroinvertebrates and fish, which would serve as a basis for identifying maintenance needs and other potential interventions as part of an adaptive management process.

Construction within the Project Area will result in temporary and short-term adverse effects on the aquatic communities. Construction impacts are primarily associated with instream disturbance as a new stream channel and bank is modified or constructed and continued soil erosion and habitat impacts that impact water quality. In riparian areas, clearing vegetation and soil disturbance would be associated with temporary roads and access to work areas, crossing streams with temporary bridges, and equipment use in and around the existing and proposed stream channel locations. The existing road system would be used to the extent possible but would require some reconstruction, such as applying gravel to existing road surfaces. Frequent maintenance would occur during periods of heavy truck use associated with hauling dirt from borrow and disposal areas, log hauling and movement of heavy equipment. Road use could be restricted immediately after heavy rains to reduce erosion runoff into the streams. Of the 663 acres initially identified as potential soil borrow/spoil disposal areas, only a portion would be disturbed because sufficient areas have been selected to provide options that would limit haul distances from borrow and disposal sites to the Project Area, thereby reducing the long-term impacts to aquatic habitats. Forest standards include the use of BMPs specific to the Forest Service and SCDHEC Erosion and Sediment Control Standards would be employed to limit erosion and sedimentation occurring both pre- and post-construction. Forest Plan standards would include use of water-bars on temporary roads, soil ripping, grading, disking at log landings and equipment staging areas followed by revegetation with grasses and forbs. This would reduce long-term erosion and

allow vegetation to re-establish and grow. Temporary roads would be closed and revegetated after restoration work is completed with the intent to return them to a vegetated condition.

Upland soil types within the analysis area are better suited for temporary road building. Proper location of roads would reduce the risk of long-term erosion impacts on the newly constructed streams. Use of reverse-grades and temporary culverts would direct water off the road surface in small amounts before it reaches any stream channel and reduce overall introduction of sediments into the streams. Also the use of culverts that will allow fish passage within the streams will be incorporated into the design and construction of the new stream channels.

Temporary roads could contribute to erosion and sediment in the short-term (up to 3 years), but effective erosion control measures would mitigate the effects on soil and water. Closing temporary roads after use would allow the soil building process to begin on the road surface. As soil develops, vegetation would begin to grow. This process allows closed roads to recover to a more natural state over time.

Forest Plan Amendment for Aquatic Communities

A Project-specific Forest Plan amendment would be required for stream restoration activities. The changes are needed to accomplish the purpose and need as described in this Final EIS. Table 3-22 lists the current Forest Plan standard and the proposed changes.

TABLE 3-22: PROPOSED CHANGES TO FOREST PLAN STANDARDS

Current Forest Plan Standard	Proposed Changes*
11-2: The removal of large woody debris (pieces greater than 4 feet and 4 inches in diameter on the small end) is allowed if it poses a risk to water quality, degrades habitat for riparian-dependent species, for recreational access, or when it poses a threat to private property or National Forest infrastructures (i.e., culverts, bridges). The need for removal must be determined on a case-by-case basis. Except in unusual circumstances, woody debris embedded within the channel materials will not be removed.	Removal of wood from Project streams is permitted during restoration activities. Woody debris removed during stream restoration would be returned on a case-by-case basis unless it poses a risk to streambank and channel stability.
FW-13: Removing large woody debris from within the channel ephemeral stream zone is allowed if the woody debris poses a significant risk to stream flow or water quality, degrades habitat for riparian dependent species, or poses a threat to private property or National Forest infrastructure (e.g., bridges). The need for removal is determined on a case-by-case basis. When needed to protect water quality, excessive small woody debris (logging slash) should be removed when its entry is result of activities.	Removal of wood from Project streams is permitted during restoration activities. Woody debris removed during stream restoration would be returned on a case-by-case basis unless it poses a risk to streambank and channel stability.

*Note: Specific to this Project only

Effects of plan amendment changes are described in direct, indirect and cumulative effects of Alternative 2-Proposed Action. Placement of wood material back in streams would be done during Project design and implementation. Wood material in unnamed tributary to Clarks Creek would temporarily be removed during site-specific Project work but would be placed back in the restored stream, whenever possible. The exception to this would occur in portions of streams where placement of would could compromise the newly restored streambank and channel stability.

3.11.5 *Cumulative Effects of Alternative 2-Proposed Action*

Alternative 2-Proposed Action would likely create substantial long-term increases in stable aquatic habitat in the Project Area, thereby creating opportunities for an increased in fish and macroinvertebrates to occupy these habitats. Other forest management activities on the Enoree Ranger District include prescribed burning, timber sales, pre-commercial thinning and release of timber, southern pine beetle control, recreation trail reconstruction and maintenance, seeding of roads, skid trails, firelines, and log decks, road maintenance

(grading, brushing, and mowing), and wildlife opening management. Most of these activities are expected to continue in the near future at approximately the same levels. Private lands within or adjacent to the proposed Project Area are made up of timberland, home sites, pastures, and farmland. Intensive timber management activities on private lands, including thinning, regeneration cuts, and road building, have occurred heavily over the past 10 years within some of these areas.

The cumulative effects of the proposed Project in combination with other past, present, and future actions are anticipated to result in a significant increase in aquatic habitats and potential increases in species diversity, distribution, and density of aquatic species with the Project.

3.12 CULTURAL RESOURCES

3.12.1 *Affected Environment*

Brockington and Associates, Inc. (Brockington) performed an initial cultural resources reconnaissance survey for the proposed stream restoration to identify and document cultural resources and evaluate their eligibility for listing on the National Register of Historic Places (NRHP) using the criteria established under 36 CFR 60 and 36 CFR 800. Based on the expected probability of occurrence of archaeological sites, Brockington defined Study Area 1 as 150 feet on either side of a stream or proposed access corridor to the Project Area. The survey included background research, development of a predictive model to identify areas of high probability of previously unrecorded cultural sites within Study Area 1 (Figure 3-29), and preliminary field investigations. The field investigations included pedestrian inspection and limited shovel testing distributed across the four watersheds in areas that the predictive model indicated to have moderate to high potential for encompassing cultural properties. In addition, Brockington monitored trenching activities in the Project Area and noted that the trenching occurred in areas with low or, in some cases, moderate potential for archaeological sites (Brockington in Preliminary Final 2014).

Archival research identified 8 known archeological sites within 150 feet of a stream or proposed access corridor in the Project Area (Harmon 2012; Sipes 2011; Fletcher et al. 2004; Wheaton and Chapman 2000; Freer 1993; Wise and Bates 1993; Graf and Kingsborough 1992; Jones 1992 all as cited in Brockington Preliminary Final 2014). One of those sites, 38CS0192, a pre-contact lithic scatter in the watershed of the unnamed tributary to Clarks Creek, is believed to contain information bearing on important archaeological research but remains unevaluated in terms of its eligibility for listing on the NRHP. The other 7 sites are deemed to be ineligible for listing on the NRHP. Due to prolonged agricultural exploitation, the Project Area and surrounding lands were highly disturbed before the Forest Service acquired them. No cultural materials or subsurface anomalies were encountered during pedestrian inspections throughout Study Area 1 or as a result of limited shovel testing at 13 locations within Study Area 1. Trench monitoring revealed areas that may require additional monitoring (Brockington in Preliminary Final 2014) and restoration activities within individual watersheds probably will require additional surveys.

3.12.2 *Direct and Indirect Effects of Alternative 1-No Action*
The cultural properties may be subject to additional erosion and disturbance as a result of Alternative 1-No Action.

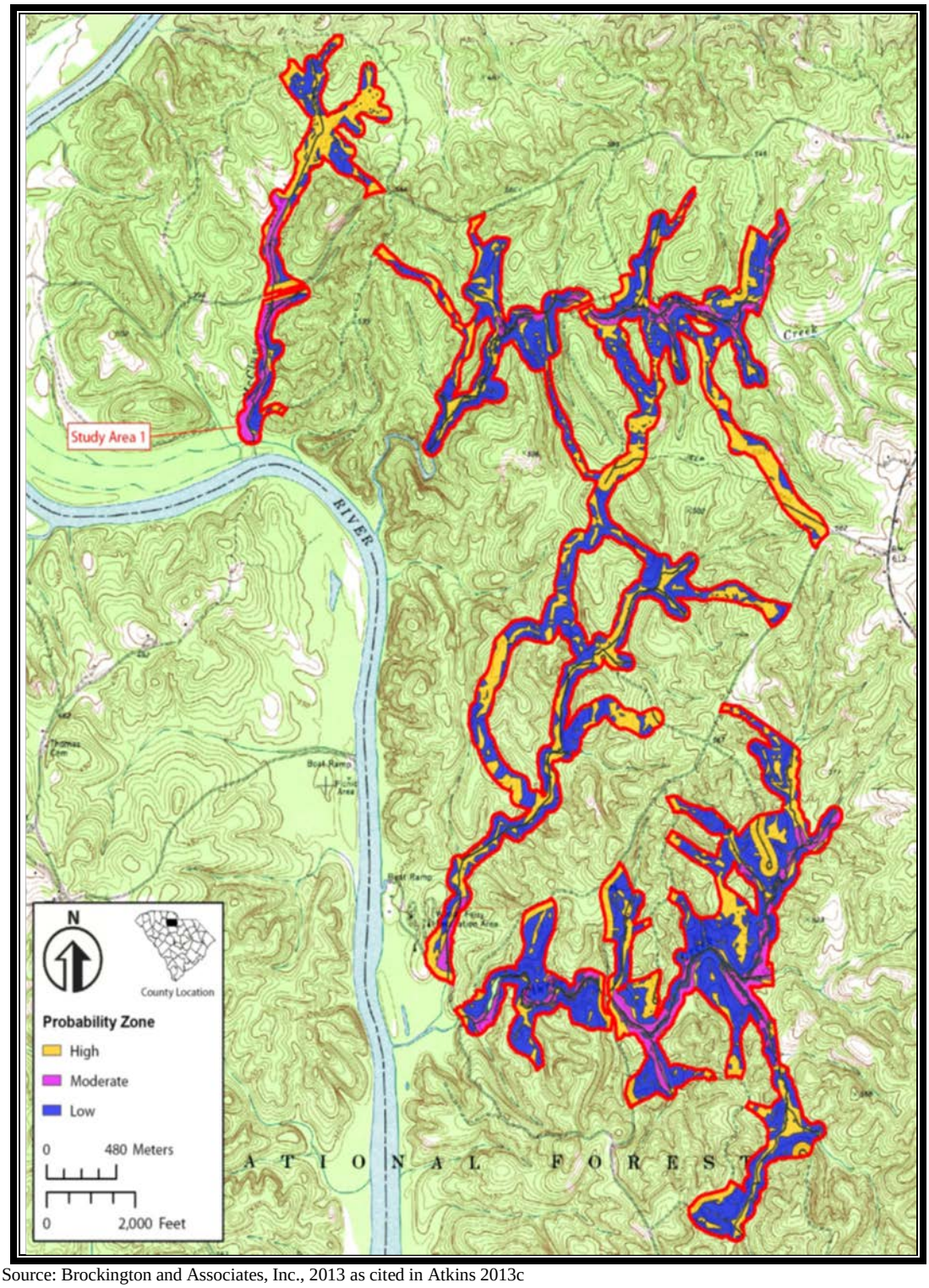
3.12.3 *Cumulative Effects of Alternative 1-No Action*
Alternative 1-No Action would produce no cumulative effects on cultural properties.

3.12.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*
As part of the stream restoration, the Forest Service is preparing a Programmatic Agreement that will account for effects of Alternative 2-Proposed Action and connected actions on cultural resources. The draft Programmatic Agreement identifies the Area of Potential Effects (APE) and provides for a revised Cultural Landscape Overview and Predictive Model (Revised Predictive Model). The Revised Predictive Model would be used to evaluate the potential for cultural resources in the stream restoration areas, identify any areas with high probability for archaeological sites, and specify why they are considered high-probability areas. The draft Programmatic Agreement includes location testing of any high-site probability areas identified. All work related to Section 106 of the NRHP will be conducted in accordance with the South Carolina Standards and Guidelines for Archaeological Investigations and the Forest Service Manual (FSM 2360) and Forest Service Handbook (FSH 360). The draft Programmatic Agreement will be developed in consultation with the ACHP, South Carolina SHPO, and the Catawba Indian Nation Tribal Historic Preservation Officer (THPO).

Construction activities could inadvertently disturb or destroy historic properties in the APE. The potential for historic properties in the stream restoration areas would be examined and subsurface testing would be used to determine if historic properties would be affected. Further consultation would determine how to mitigate any adverse effects on historic properties.

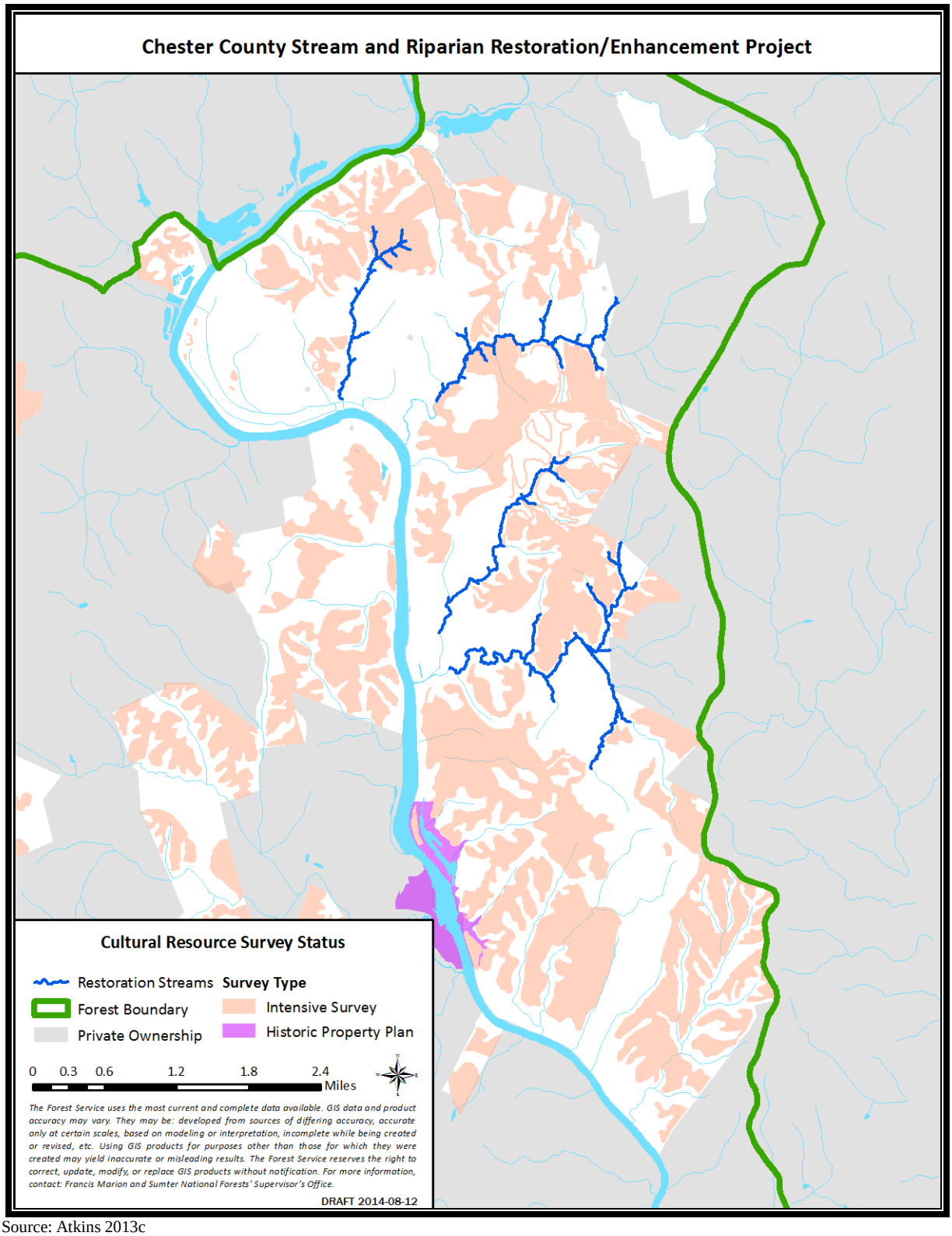
The Programmatic Agreement also includes provisions for intensive archaeological survey of the areas associated with the connected action of soil borrow and disposal areas, transportation corridors including proposed roads, equipment staging areas, and any sites subjected to other activities that may affect historic properties. The surveys would identify historic properties associated with any connected actions, and those areas will be avoided, if possible, or mitigation will be identified in consultation with the appropriate agencies and stakeholders.

3.12.5 *Cumulative Effects of Action Alternative 2-Proposed Action*
Avoiding known historic properties would ensure no cumulative adverse effects during any forest management activity.



Source: Brockington and Associates, Inc., 2013 as cited in Atkins 2013c
The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

FIGURE 3-29: PREDICTIVE MODEL FOR PREVIOUSLY UNRECORDED SITES OF PREHISTORIC HABITATION WITHIN THE PROJECT AREA



Source: Atkins 2013c

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FIGURE 3-30: CULTURAL RESOURCE SURVEY STATUS

3.13 SCENERY AND RECREATION

3.13.1 *Affected Environment*

SCENERY

The Project Area is located in the Enoree Ranger District of the Sumter National Forest and is characterized by wooded, rolling hills typical of the Piedmont physiographic region. The surrounding setting is rural; forested lands are interspersed with pasture lands, croplands, industrial timberlands, and small communities. The Project Area is bounded to the north and west by the Broad River and joined by private property to the south and east. Forested communities are primarily composed of loblolly pine interspersed with patches of upland hardwood (USFS 2004a).

The Sumter National Forest provides high-value opportunities for wildlife viewing and driving for pleasure. Scenic resources are viewable from many different vantage points, including roads, trails, rivers, and campsites. Lands adjacent to highly visible areas are especially important for scenery management. The environment of certain areas of the Sumter National Forest has been modified substantially for uses such as recreation (USFS 2004a).

The Forest Plan presents the Forest Service's goals and standards specifically relating to scenic resources. Table 3-23 presents the goals and standards relevant to the Project Area.

TABLE 3-23: FOREST PLAN GOALS AND STANDARDS FOR SCENIC RESOURCES IN THE PROJECT AREA

Forest Plan Goals	
Goal 30	To protect and enhance the scenic and aesthetic values of the national forest lands in the Southern Appalachians and Piedmont.
Forest Plan Standards	
FW 89	The Forest SIO[1] Maps and SIO in each prescription governs all new projects (including special uses). Assigned SIOs are consistent with ROS[2] management direction. Existing conditions may not meet the assigned SIO.
FW 90	The Scenery Management System guides scenery protection and enhancement of the Sumter National Forest. The scenic class inventory will be maintained, refined, and updated as a result of site-specific project analysis. The standards under each Management Prescription in Chapter 3 refer to the inventory as updated.

[1] SIO Scenic Integrity Objectives
2 ROS Recreation Opportunity Spectrum

Sumter National Forest scenic resources are managed in part through SIOs established in the Forest Plan. SIOs are implemented to maintain or enhance the scenic and natural values of the area and to describe the degree of acceptable alteration of landscape characteristics. Scenic inventory classifications of the value of resources in the Sumter National Forest range from "very low" to "very high" and are defined as follows (USFS 2004a):

- Very Low (VL): landscape that is heavily altered;
- Low (L): landscape that appears moderately altered; human-created deviations begin to dominate the valued landscape character being viewed but borrow from valued attributes such as size, shape, edge effect, pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed;
- Moderate (M): landscapes appear slightly altered; noticeable human-created deviations must remain visually subordinate to the landscape character being viewed;
- High (H): human activities are not visually evident to the casual observer; activities may only repeat attributes of form, line, color, and texture found in the existing landscape character;
- Very High (VH): generally provides for only ecological changes in natural landscapes and complete intactness of landscape character in cultural landscapes.

The Forest Service notes that scenic landscapes are generally associated with, or occur adjacent to, lakes, rivers, streams, highly developed recreation areas, and national trails (USFS 2004a). As depicted in Table 3-24, high SIO surround the Broad River riparian corridor, the Woods Ferry Horse Trail, portions of each restoration stream near their confluence with the Broad River and where they intersect the Woods Ferry Horse Trail, and County Road 574 leading from the Woods Ferry Recreation Area to Leeds Shooting Range. The Forest Service describes the "valued landscape character" as being "intact" in these areas. High SIOs promote the Forest Plan goal of providing a scenic context that adds to the visitor's overall experience (USFS 1995 as cited in Atkins 2013d).

Moderate SIO surround the remaining portions of the Project Area and are primarily confined to the interior forest lands. Landscapes in these areas are considered "slightly altered" and are generally less visible to the public. Moderate SIO allow for the variety of recreation and timber production activities that take place within the forest interior.

TABLE 3-24: SCENIC INTEGRITY OBJECTIVES SURROUNDING RESTORATION STREAMS WITHIN A 500-FOOT BUFFER

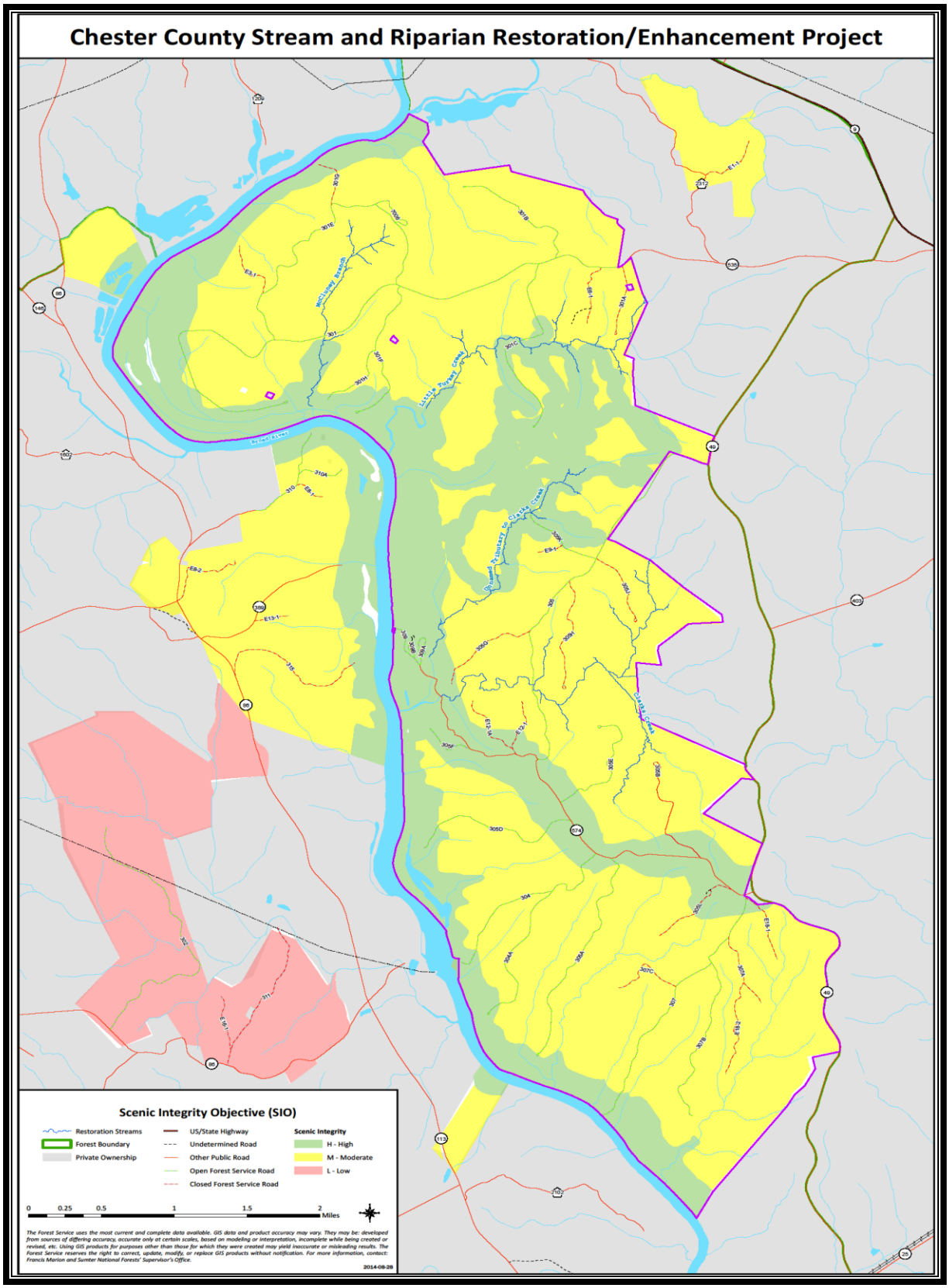
Restoration Stream	Total Acreage	High SIO Acreage	Moderate SIO Acreage
McCluney Branch	301.5	67.2	234.3
Little Turkey Creek	411.0	146.3	264.8
UT to Clarks Creek	317.3	208.2	109.0
Clarks Creek	639.7	31.8	607.9

Stream restoration could significantly alter the existing character of the landscape and affect the scenic resource. Although, much of the landscape surrounding the restoration streams is currently in a degraded biological state, stream restoration would affect scenery by altering landscapes, species diversity, and forest structure. The potential effects may be positive or negative depending on implementation.

RECREATION

Recreation opportunities within the Enoree Ranger District of Sumter National Forest include day-use activities such as fishing, hunting, primitive camping, picnicking, hiking, horseback riding, boating, and recreational shooting ranges. The forest supports an extensive trail network that is very popular with hikers and horseback riders; moreover, the statewide Palmetto Trail-Enoree Passage crosses this district. The historic Rose Hill State Park is located in the middle of the Enoree Ranger District (Atkins 2013d).

The Forest Plan presents the Forest Service's goals, objectives and standards specifically relating to recreation resources. Table 3-25 presents the goals, objectives and standards that relate to the Project Area.



Source: USFS 2014

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FIGURE 3-31: SCENIC INTEGRITY OBJECTIVE

TABLE 3-25: FOREST PLAN GOALS, OBJECTIVES AND STANDARDS FOR RECREATION RESOURCES IN THE SUMTER NATIONAL FOREST

Forest Plan Goals and Objectives	
Goal 22	Provide a spectrum of high quality nature-based recreational settings and opportunities that reflect the unique or exceptional resources of Sumter National Forest and the interests of the recreating public on an environmentally sound and financially sustainable basis. Adapt management of recreation facilities and opportunities as needed to shift limited resources to those opportunities.
Goal 23	Where financially and environmentally feasible, enhance the following opportunities: hiking, biking, canoe, kayak, raft and equestrian trail systems, especially in non-motorized settings with high quality landscapes designated off-highway vehicle (OHV) routes high-priority improvements, expansions, or additions of facilities to provide developed recreational opportunities hunting, fishing, wildlife, bird, and plant viewing opportunities educational and interpretive opportunities
Objective 23.01	Maintain or improve 150 acres of ponds/lake habitat for recreational fisheries
Objective 23.02	In the Piedmont, increase acreage that is at least ½ mile from an open road to 35,000 acres, emphasizing land blocks that are at least 2,500 contiguous acres in size
Goal 24	Enhance opportunities to provide backcountry (semi-primitive motorized and non-motorized/ remote) recreational experiences that are generally not available on other land ownerships
Goal 25	Provide a range of accessible recreation facilities and trails
Forest Plan Standards	
FW-69	Limit OHVs and mountain bikes to designated routes
FW-70	Prohibit camping stays over 14 days, unless permitted
FW-72	Dispersed camping is not allowed on the Enoree and Long Cane ranger districts without a permit
FW-73	Motorized use of the trail system is permissible for administrative purposes and emergencies
FW-74	All management activities will be consistent with meeting or exceeding the condition associated with each ROS class
FW-75	At developed recreational sites and on trails, effects from recreational use that conflicts with environmental laws (such as Endangered Species Act, National Heritage Preservation Act, or Clean Water Act), are analyzed and mitigated
FW-76	At developed recreational sites, water, wastewater, and sewage treatment systems meet federal, state and local water quality regulations
FW-77	At developed recreation sites high-risk conditions do not exist
FW-78	At developed recreation sites, utility inspections meet federal, state and local requirements
FW-79	When signed as accessible, constructed features meet current accessibility guidelines
FW-80	Trails, when signed accessible, meet current accessibility guidelines

Developed Recreation Sites and Dispersed Recreation

Recreation in the Sumter National Forest may be dispersed or may occur at developed recreation sites. Dispersed recreation is defined as occurring outside of developed recreation sites and may include activities such as boating, fishing, hiking, mountain biking, and horse riding. A developed recreation site is defined as a discrete place containing a concentration of facilities and services used to provide recreation opportunities to the public. Developed sites include campgrounds, picnic areas, shooting ranges, swimming beaches, and historic sites. Developed recreation sites may provide access to dispersed use through trailheads or boat ramps (Atkins 2013d).

Developed recreation facilities in the Project Area include the Woods Ferry Recreation Area, the Woods Ferry Horse Trail Trailhead parking area, Poulous Loop Seasonal Campground, and the Leeds Shooting Range (Figure 3-36).

Woods Ferry Recreation Area

The Woods Ferry Recreation Area (Figure 3-33) is located on the Broad River at the end of County Road 574. It is the largest developed facility in the Project Area and includes 28 family campsites with tables and grills (maximum capacity: 8 people and 2 vehicles each), and 1 group campsite (maximum capacity: 14 people and 4 vehicles). Water spigots and hot showers are centrally located. Horse corrals are available at 10 of the family campsites and 1 of the group campsites. The Woods Ferry Picnic Area includes 2 picnic shelters and 3 accessible fishing platforms. The Picnic area also includes 25 picnic tables and grills. A paved boat ramp to the Broad River is also available at the Woods Ferry Recreation Area (Atkins 2013d).

Trailhead

Access to the Woods Ferry Horse Trail system is provided through an existing trailhead located off of Forest Service road 301C. The trailhead provides a graveled parking area, an information board, and several hitching posts for the equestrian users. A new trailhead is planned off of Bucks Grave Road and will also provide a graveled parking area upon completion.

Poulous Loop Seasonal Campground

The Poulous Loop Seasonal Campground (Figure 3-34) is located in the northern portion of the Project Area and is open seasonally. Although not as well developed as the Woods Ferry Recreation Area, Poulous Loop facilities include 13 primitive campsites, each with a maximum capacity of 8 people, and 1 restroom facility (Atkins 2013d).

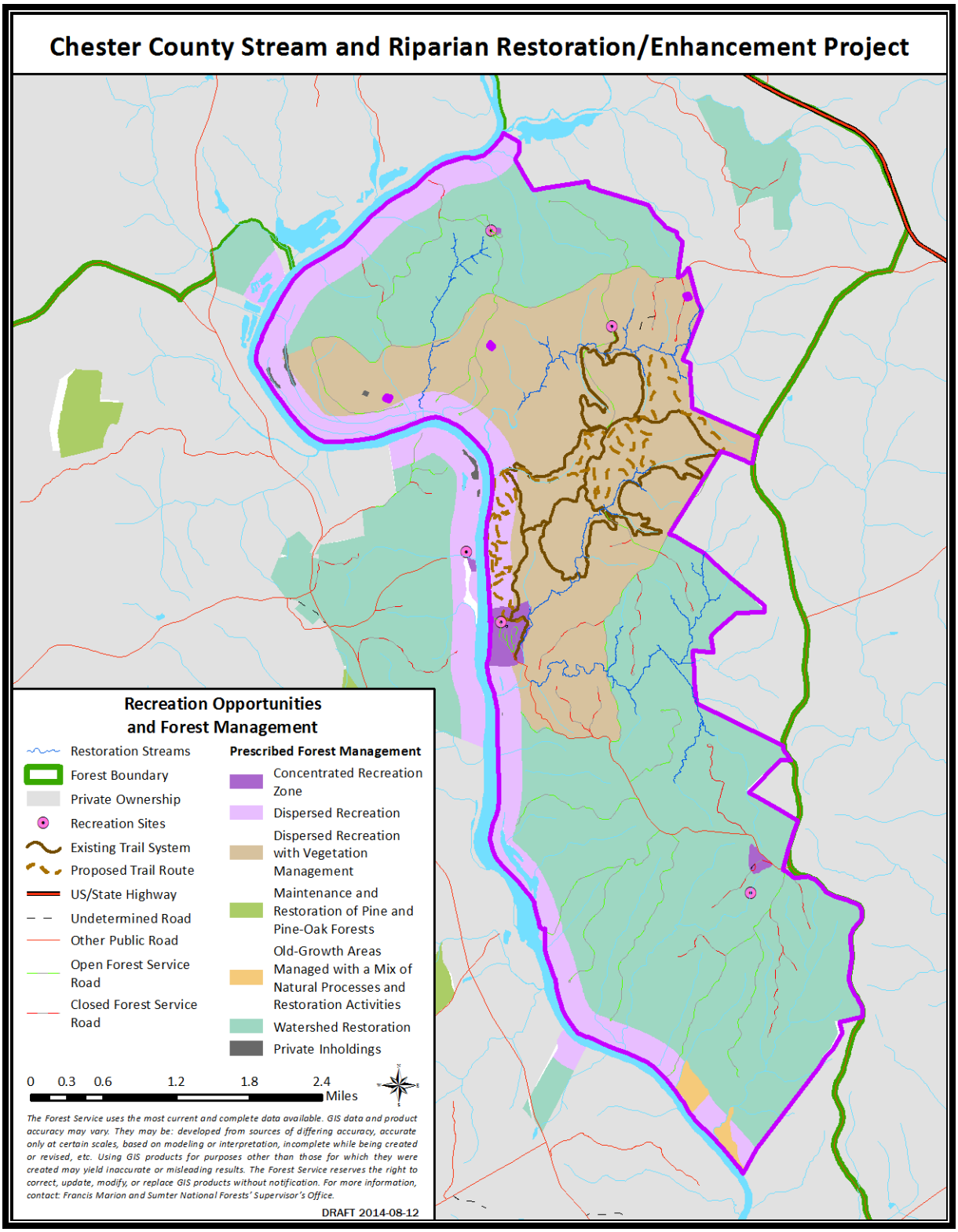

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FIGURE 3-32: RECREATIONAL OPPORTUNITIES AND FOREST MANAGEMENT WITH IN SUMTER NATIONAL FOREST

Leeds Shooting Range

The Leeds Shooting Range (Figure 3-36) is located just south of Highway 574 and is well used year-round. Facilities primarily include a rifle shooting range with 6 covered shooting tables. Only target shooting is permitted; no skeet or trap shooting is allowed (Atkins 2013d).

Dispersed Recreation Use

Dispersed recreation is defined as occurring outside of developed recreation sites and may include activities such as boating, fishing, hiking, mountain biking, and horseback riding.

The Woods Ferry Horse Trail

The Woods Ferry Horse Trail (Figure 3-35) is well used by hikers, horseback riders, and mountain bikers. The Sumter National Forest Enoree Ranger District encompasses more than 15 miles of existing trails; 5 miles of new trails are proposed for inclusion in the trail system. Existing trails connect to the Woods Ferry Recreation Area and extend north and east across wooded areas and several streams, including 2 streams that are part of the proposed restoration Project (Atkins 2013d). The trail system currently includes 5 crossings over stream sections included under Alternative 2-Proposed Action. The trail to Turkey Creek would remain open to allow water access for horses. The proposed new trails include the River Trail, which traverses the forest adjacent to the Broad River.

Hunting

The surrounding forest environment sustains abundant wildlife populations, making it one of the most desirable hunting areas in the state. Hunting is regulated by the SCDNR and is permitted anywhere in the Sumter National Forest during the specified hunting seasons, except for within 150 yards of a developed recreation site.

Other Recreation Resources in the Project Area

The Neal Shoals Dam, owned and operated by South Carolina Electric & Gas Company, is located on the Broad River just south of the Woods Ferry Recreation Area. There is a portage around the dam for canoes and kayaks, and a popular water access area and fishing area is located at the base of the dam. The Forest Service does not maintain this area (Atkins 2013d).

FIGURE 3-33: WOODS FERRY RECREATION AREA

FIGURE 3-34: INFORMATION BOARD AT POULOUS LOOP SEASONAL CAMPGROUND

FIGURE 3-35: WOODS FERRY HORSE TRAIL

FIGURE 3-36: LEEDS SHOOTING RANGE

Developed Recreation Facilities in Relation to Restoration Streams
Recreation resources located in the Project Area may overlap, or lie adjacent to, streams proposed for restoration. These resources are indicated on Figure 3-32 and are also described by individual restoration stream.

McCluney Branch
The Poulous Loop Seasonal Campground is located at the northern tip of McCluney Branch. Several access roads pass in the vicinity of this stream including Forest Service roads 301, 301E, 301H, and 7006.

Little Turkey Creek
Little Turkey Creek is bounded to the south by an extensive trail system. Several miles of existing and proposed trails run right along the stream channel (Figure 3-32). Several access roads pass in the vicinity of Little Turkey Creek, including Forest Service roads 301A, 301C, 301F, and E61. An existing trail head is located off road 301C, north of the restoration stream. A proposed trailhead will be located off Bucks Grave Road, southeast of the restoration stream.

Unnamed Tributary to Clarks Creek
The unnamed tributary to Clarks Creek is surrounded by the horse trail network. Although most of the trail network lies to the north of the unnamed tributary to Clarks Creek, several miles of trail pass south and west along the stream channel. The Woods Ferry Recreation Area lies west of the unnamed tributary to Clarks Creek. Forest Service roads 305K and E9-1 pass in the vicinity of this restoration stream.

Clarks Creek
The Woods Ferry Recreation Area is northwest of Clarks Creek and the Leeds Shooting Range, which lies to the southeast. The existing and proposed trail networks are located well to the north of this restoration stream. Several Forest Service roads pass near, or cross over, this stream, including: 305, 305B, 305E, 305G, 305H, 305J, E12-1A, E12-1.

Recreation Planning Tools
The Forest Service manages recreational resources through two primary planning tools: management prescriptions and ROS.

FOREST SERVICE MANAGEMENT PRESCRIPTIONS
The Forest Plan defines several management prescriptions designed for implementation throughout all three ranger districts of the Sumter National Forest. Management prescriptions are assigned to a particular land area in order to achieve the goals and objectives established in the Forest Plan, providing the framework for land use planning within the Sumter National Forest. Only 6 of the 27 management prescriptions within the Sumter National Forest pertain to the Project Area (Table 3-26) (USFS 2004a).

TABLE 3-26: MANAGEMENT PRESCRIPTIONS IN THE PROJECT AREA

Management Prescription	Area Description
11	Riparian Corridors
6C	Old Growth Managed with a Mix of Natural Processes and Restoration Activities
7D	Concentrated Recreation Zone
7.E.1	Dispersed Recreation (Piedmont Only)
7.E.2	Dispersed Recreation with Vegetation Management
9.A.3	Watershed Restoration

Source: Atkins 2013d

Riparian Corridors (11)

The Riparian Corridor management prescription applies to all other management prescriptions located within the Project Area. The Forest Service defines this prescription as being managed to retain, restore and/or enhance the inherent ecological processes and functions of the associated aquatic, riparian, and upland components within the corridor. Riparian management areas are inventoried by the Forest Service and are located along all defined perennial and intermittent stream channels that show signs of scour, around natural ponds, lakeshores, wetlands, springs and seeps. These management areas may overlap a larger management prescription area; however, the riparian corridor management prescription generally takes precedence (USFS 2004a).

This management prescription encompasses all of the restoration streams located in the Project Area.

Old Growth Managed Areas (6C)

According to the Forest Plan, management of these areas emphasizes protection, restoration, and management of old growth forests and their associated wildlife, botanical, recreational, scientific, educational, cultural, and spiritual values. Forest management activities are allowed to restore or maintain old-growth conditions. Recreation activities consistent with the natural landscape character are encouraged. This includes non-motorized use of trails, hiking, backpacking, dispersed camping, hunting, and angling. Aquatic and riparian protection measures (Prescription 11) apply to this prescription. More specifically, riparian corridors will be managed to retain, restore, or enhance the inherent ecological processes and functions of the associated aquatic, riparian and upland components (USFS 2004a).

Only a small portion of the southwest section of the Project Area is included in this management prescription (Table 3-26). This area does not include any designated trails or other designated recreation sites.

Concentrated Recreation Zone (7D)

This management prescription includes developed recreation areas, such as the Woods Ferry Recreation Area, concentrated use areas, and areas of high-density dispersed recreational activity. These areas are managed to provide recreationists with high-quality recreational

opportunities within a natural forested setting. These areas also serve as gateways to other recreational opportunities within the forest. Riparian protection measures (Prescription 11) apply to Concentrated Recreation Zones (USFS 2004a).

Concentrated Recreation Zones are located in the immediate vicinity of developed recreation areas in the Project Area, which include: Woods Ferry Recreation Area, Poulous Loop Seasonal Campground and Leeds Shooting Range**.**

Dispersed Recreation-Piedmont Only (7.E.1)
This management prescription is unique to the Piedmont area of the Sumter National Forest, specifically within a quarter of a mile of the Enoree, Tyger, and Broad rivers. Within the Project Area it is located entirely within an area designated for high SIO (Table 3-24). Scenic values are an important consideration in this management prescription. The Forest Plan describes this prescription as "managed to provide the public with a variety of recreational opportunities in a setting that provides quality scenery, numerous trails, and limited facilities." Recreation opportunities are provided in a roaded natural or rural setting. Prescription 11, aquatic and riparian protection, applies to this management prescription. Tree harvest may be permitted to control insect infestation or disease, to remove salvage timber, to maintain moderate stand densities, to create small canopy gaps, or to create openings for canebrakes (USFS 2004a).

Within the Project Area, this management prescription is located along the east side of the Broad River (Table 3-26).

Dispersed Recreation Areas with Vegetation Management (7.E.2)
This management prescription is intended to provide for a variety of dispersed recreation opportunities in a roaded natural and rural setting, improve the settings for outdoor recreation, and enhance visitors' experiences in a manner that protects and restores the lands. Recreation opportunities available within this management prescription may include horseback riding, hiking, hunting, fishing, and mountain bike riding. These areas receive moderate to high recreational use. Timber production is compatible with this prescription, and aquatic and riparian protection measures (Prescription 11) apply to this prescription (USFS 2004a).

This management prescription is located in the north central portion of the Project Area and includes the trail system (Table 3-26).

Watershed Restoration (9.A.3)
This prescription emphasizes improving watershed conditions and associated water quality and soil productivity in areas affected by past land uses. Intense ground disturbance with temporary to short-term effects may be necessary in this prescription to restore and stabilize these areas. Eroding stream banks are to be stabilized and restored whenever possible. Once restored, watersheds under this management prescription will be allocated to a different prescription. Similar to other prescriptions, the aquatic and riparian protection measures under Riparian Prescription 11 apply to this prescription (USFS 2004a).

This management prescription occupies the largest section of the Project Area, primarily along the southern half and the northern border of the Project Area. This prescription includes the restoration streams, as well as the Leeds Shooting Range.

FOREST MANAGEMENT PRESCRIPTIONS IN RELATION TO RESTORATION STREAMS

Forest management prescriptions in the Project Area may encompass, or lie adjacent to, streams proposed for restoration.

McCluney Branch

McCluney Branch is located within several forest management prescriptions, including 9.A.3-Watershed Restoration, 7.E.1-Dispersed Recreation, 7.E.2-Dispersed Recreation with Vegetation Management, and 11-Riparian Corridor. A Concentrated Recreation Zone Prescription (7D) surrounds the Poulous Loop Seasonal Campground to the north-east of the restoration stream. The direction in the Riparian Corridor Management Prescription 11 takes precedence.

Little Turkey Creek

Little Turkey Creek is located in the following forest management prescriptions: 7.E.1-Dispersed Recreation; 7.E.2-Dispersed Recreation with Vegetation Management; and 11-Riparian Corridor. As noted, Prescription 11 takes precedence. A proposed trailhead will be located just off of Bucks Grave Road, southeast of the restoration stream.

Unnamed Tributary to Clarks Creek

Unnamed tributary to Clarks Creek is located primarily within 7.E.2-Dispersed Recreation with Vegetation Management. A Concentrated Recreation Zone Prescription (7D) surrounds the Woods Ferry Recreation Area to the west of the restoration stream. Prescription 7.E.1-Dispersed Recreation runs along the Broad River and to the west of the restoration stream. Riparian Corridor (11) surrounds the unnamed tributary to Clarks Creek stream channel and takes precedence.

Clarks Creek

Clarks Creek transverses several forest management prescriptions, including 7.E.2-Dispersed Recreation with Vegetation Management Prescription and 9.A.3-Watershed Restoration. The Woods Ferry Recreation Area and the Broad River lie to the west, with their associated prescriptions (7D and 7.E.1). Riparian Corridor (11) surrounds the Clarks Creek stream channel and takes precedence.

RECREATION OPPORTUNITY SPECTRUM

The ROS is implemented in conjunction with the SIO and is used to identify and evaluate recreation settings in the Sumter National Forest. The 5 ROS classifications for National Forest System lands are designed to promote satisfying experiences for the recreationist (Table 3-27). An area's ROS designation dictates allowable uses within a management prescription. In general, the ROS classes are distinguished by an area's proximity to other human development, the size of the forest parcel, and the number of visitors that are allowed on a site (Atkins 2013d).

TABLE 3-27: RECREATION OPPORTUNITY SPECTRUM CLASSIFICATIONS

ROS Class	Description
Primitive	The most remote, undeveloped recreation setting on the forest. These settings are generally located at least 3 miles from any open road and are 5,000 acres in size or larger. Groups of visitors are often limited to a specific size to retain a sense of isolation and solitude.
Semi-Primitive Non-Motorized	Areas are less remote and can be as small as 2,500 acres and only a half-mile or more from any open road. These settings accommodate dispersed non-motorized recreation.
Semi-Primitive Motorized	Less remote and can be as small as 2,500 acres and only a half-mile or greater from any open road. These settings accommodate dispersed motorized recreation.
Roaded Natural	Located within a half-mile of a road and usually provide higher levels of development such as campgrounds, picnic areas, and river access points.
Rural	Characterized by a substantially modified natural environment. Resource use and modification practices enhance specific recreation activities and facilities are generally designed for use by a large number of people.

Source: Atkins 2013d

Most of the Project Area is classified as roaded natural, and the remaining area is classified as rural. The roaded natural ROS classification is characterized by "moderate evidence of the sights and sounds of man" (USFS 1982 as cited in Atkins 2013d). Rural ROS classification is intended to enhance specific recreation activities while maintaining natural features. The rural ROS classification surrounds developed recreation sites within the Project Area including the Woods Ferry Recreation Area and Leeds Shooting Range which are located in the vicinity of the unnamed tributary to Clarks Creek and Clarks Creek. ROS classifications are depicted on Figure 3-37.

TABLE 3-28: MANAGEMENT PLAN PRESCRIPTIONS AND RECREATION OPPORTUNITY SPECTRUM ACREAGES FOR THE PROJECT AREA

Sumter Revised Land And Resource Management Plan Prescription	Acreage	Recreation Opportunity Spectrum
11-Riparian Areas	2128.6	Rural; Roaded Natural
6C-Old Growth Managed with a Mix of Natural Processes and Restoration Activities	66.4	Roaded Natural
7D-Concentrated Recreation Zone	116.5	Rural
7.E.1-Dispersed Recreation (Piedmont Only)	1409.1	Roaded Natural
7.E.2-Dispersed Recreation with Vegetation Management	3613	Roaded Natural
9.A.3-Watershed Restoration	6315.2	Roaded Natural

RECREATION USE PATTERNS IN THE PROJECT AREA

More than 1.3 million people are estimated to partake in recreational activities within the Francis Marion and Sumter National Forests each year (USFS 2008 as cited in Atkins 2013d). The Sumter National Forest is readily accessible to other portions of South Carolina, as well as the surrounding states of Georgia, North Carolina, and Tennessee. Studies confirm that most of the visits originate from within a 75-mile radius of the forest, which provides access from major cities, including Charlotte, North Carolina; and Greenville and Columbia, South Carolina. Most visits to Francis Marion and Sumter National Forests are day visits, most lasting less than 4 hours, and many of the visitors are sightseers, hunters and trail users. Fifteen percent of the visits involve recreating at multiple sites within the Sumter National Forest (USFS 2008, 2004a, 2004b as cited in Atkins 2013d).

More specifically, the Forest Service collected use data at selected locations in the Project Area using trail and traffic counters. Eleven counters were placed throughout the Project Area in March and April, 2014 and collected data through October 2014. Generally, counter data indicates that approximately half of the site visits occur during the weekend (Saturday and Sunday). An exception to this occurred at site 4 (after Leeds Shooting Range) and site 6 (Poulous Loop Seasonal Campground). Site 4 experienced consistent use during each day of the week throughout the data collection period. Site 6 experienced the greatest amount of use on Monday, Tuesday, and Saturday for the data collection period. It should be noted that the counter at Site 6 was only in place during March and April 2014 to cover spring turkey season. Site 7, the Woods Ferry Picnic Area, received a high amount of use during the collection period; however, this site is likely receiving multiple visits from individuals driving back and forth to use the campground or fish without leaving the Woods Ferry Recreation Area. Site 5, the Leeds Shooting Range, also received a high amount of use, comparatively, during the collection period.

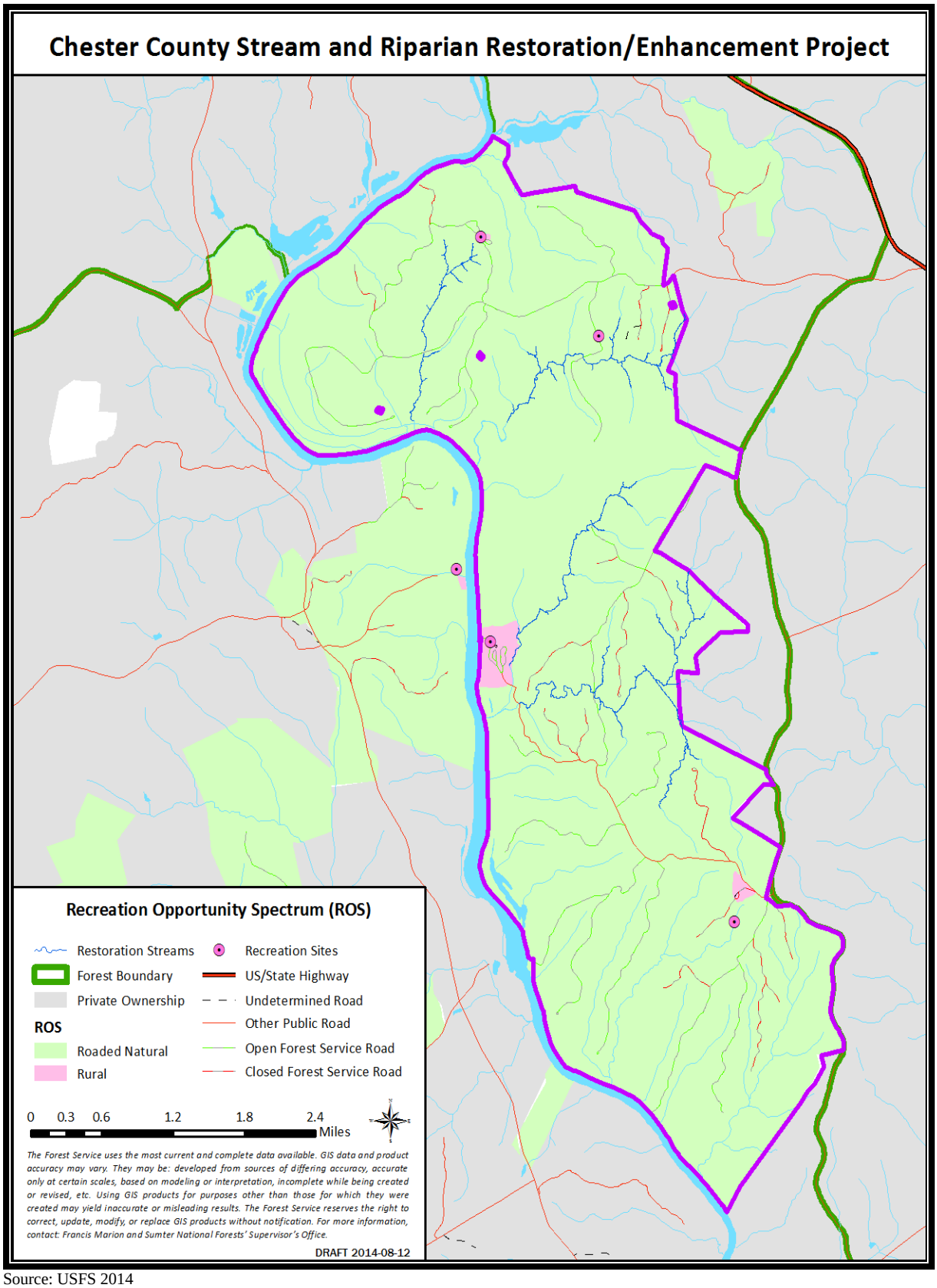
TABLE 3-29: PROJECT AREA TRAFFIC AND TRAIL COUNTER SUMMARY

Site Number	Site Name	Site Location	Average Daily Traffic	Date In-Service	Type	Restoration Stream Vicinity (Restoration Priority)
1	FSRD301	Forest Service Road 301	13.7 Vehicles	April 7, 2014	Vehicle	N/A
2	FSRD301C	Forest Service Road 301C to Trailhead Parking	7.8 Vehicles	April 7, 2014	Vehicle	N/A
3	FSRD304Dam	Road 304 to Neal Shoals Dam	12.7 Vehicles	April 7, 2014	Vehicle	N/A
4	FSRD307	Road 307 after Leeds Shooting Range (may include overflow parking from range or hunting activity)	3.8 Vehicles	April 7, 2014	Vehicle	N/A
5	Leeds RR	Leeds Shooting Range (only those vehicles entering range)	26.1 Vehicles	April 7, 2014	Vehicle	N/A
6	Poulous camp	Poulous Loop Seasonal Campground	5.6 Vehicles	March 28, 2014	Vehicle	Near McCluney Branch (FR)
7	WF Picnic	Woods Ferry Picnic Area	20.6 Vehicles	April 7, 2014	Vehicle	Near U.T. to Clarks Creek (FB)
8	WF Camp	Woods Ferry Recreation Area Main Entrance Road (must drive past to enter site)	14.9 Vehicles	April 7, 2014	Vehicle	Near U.T. to Clarks Creek (FB)
9	WFTL Bucks Grave Road	Trail - Bucks Grave	2.5 Individuals	April 7, 2014	Trail	Near U.T. to Clarks Creek (FB)
10	WFTL Purple	Trail (Purple) near Woods Ferry Recreation Area Campground	6.3 Individuals	April 7, 2014	Trail	Near U.T. to Clarks Creek (FB)
11	WFTLParking	Trail (White) near Trailhead	3.7 Individuals	April 7, 2914	Trail	Near Little Turkey Creek (FR)

[a] The Poulous Loop recreation site is open seasonally for hunting and closed during the remainder of the year. The vehicle counter at this site collected data through the beginning of May.

Key:

FB	Floodplain Benches
FR	Floodplain Reconnection
FSRD	Forest Service Road
RR	Rail Road
WF	Woods Ferry
WFTL	Woods Ferry Trail Loop



Source: USFS 2014

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FIGURE 3-37: RECREATION OPPORTUNITY SPECTRUM

3.13.2 *Direct and Indirect Effects of Alternative 1-No Action*

SCENERY

No substantial direct impacts on the visual character of the Project Area are anticipated under Alternative 1-No Action. Without the proposed stream restoration, erosion would continue to affect the riparian areas and additional trees would be likely to fall into the stream corridor. Trees in the Project Area would be more susceptible to rot and disease, which may have an adverse effect on recreational trail users. Recreation users adapted to the Project Area's current landscape character would notice little to no change under Alternative 1-No Action. This alternative would not impact existing SIO designations.

RECREATION

No significant impacts on recreation resources, or the current distribution of the ROS, are anticipated under Alternative 1-No Action. Recreation activities that predominate under the roaded natural and rural ROS classification, including horseback riding, hiking, hunting, fishing, mountain bike riding, would likely remain stable or increase slightly with recreation use trends under this alternative. Alternative 1-No Action would not result in any disturbance to developed or dispersed recreation activities.

3.13.3 *Cumulative Effects of Alternative 1-No Action*

SCENERY

Cumulative impacts on scenic resources may occur as a result of continuing activities. These activities generally include prescribed burning, road maintenance, timber harvest, and other forest management actions. Timber is harvested sporadically but not widespread across the Enoree Ranger District in the Project Area. The overall visual effect on national forest system lands would be minimal, and cumulative effects on visual quality would be temporary and local to the Project Area watersheds.

RECREATION

Cumulative effects on recreation opportunities, experiences, and settings may occur as a result of ongoing forest management activities. These activities generally include prescribed burning, road maintenance, timber harvest, and maintenance of wildlife openings. During implementation of these activities, there would likely be temporary effects to developed or dispersed recreation access within the Project Areas. These activities would continue regardless of whether the Forest Service implements Alternative 2-Proposed Action.

3.13.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

SCENERY

Scenic resources are affected by management activities that alter the appearance of the landscape. This alternative involves the following 6 kinds of activity:

1. stream restoration using 3 approaches (i.e., P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches),
2. site preparation and construction during restoration,
3. removal of trees for construction activities and for the connected actions of soil borrow and fill areas,
4. construction of temporary roads and bridges,

5. maintenance of existing roads, and
6. revegetation following construction and closure of temporary roads.

All acres within the Project Area (i.e., 11,605 acres) have a SIO that defines the desired condition as set forth in the Forest Plan. The Forest Plan assigns SIOs that provide guidance for how each acre of the forest is to be managed to achieve the desired condition. Restoring the 4 streams in the Project Area would improve the scenic quality and meet the Forest Plan objective of very high scenic integrity in the long-term (approximately 10 years); however, scenic resources would be adversely affected in the short-term (approximately 5 years). A Forest Plan Amendment would be required to temporarily re-assign areas with a high SIO to a moderate SIO. The following sections describe the short- and long-term effects on the scenic quality of Sumter National Forest Enoree Ranger District for each of the proposed stream restoration methods.

The P1-floodplain reconnection restoration approach would raise the stream to meet the floodplain, resulting in a wetter or “spongy” meadow environment in the floodplain. P1-floodplain reconnection would shift community composition because species that are intolerant of moist soil conditions would die, and more tolerant species would become established over time. In addition, the number of standing dead trees in the floodplain would increase. Standing trees would be selectively removed to provide access to the streams and associated riparian areas and trees would be reused in the restoration to increase habitat and scenic value, where possible. In addition, water-tolerant species would be re-planted in the reconnected floodplain and visual landforms, such as large rocks, would be included in the stream design. The spongy meadow and new meandering streams implemented through the stream design would provide scenic enhancement. Natural materials consistent with Piedmont characteristics would be incorporated, where possible. Vegetation in the restored areas, including standing dead trees, would be monitored both in the short-and long-term. To maintain the natural appearance, affected areas would be revegetated. If revegetation does not succeed, affected areas would be re-planted. The following series of photographs present scenic examples of a typical stream before, during, and after P1-floodplain reconnection (Figure 3-38).

Stream before P1-Floodplain Reconnection Restoration

Stream during P1-Floodplain Reconnection Restoration

Stream just after P1-Floodplain Reconnection Restoration

Stream 3 Years after P1-Floodplain Reconnection Restoration

FIGURE 3-38: SCENIC EXAMPLES OF A TYPICAL STREAM BEFORE, DURING AND AFTER P1-FLOODPLAIN RECONNECTION

The P2-floodplain excavation approach would create a new floodplain near the current bankfull elevation, enabling floodwaters to access a new floodplain. This approach would require removing some forest canopy, which would produce the short-term visual effect of creating large openings and the resulting contrasts in form, line, color, and texture. The magnitude of the effects on scenery would depend on the size, shape, and location of the openings. Open canopies would admit more light and increase species structure and diversity. To minimize visual effects, larger trees would be planted near trail crossings and scenic vistas, where practicable. Visual landforms, such as large rocks and natural materials commensurate with Piedmont characteristics, would be incorporated into stream design, where applicable. Openings would be shaped organically, and vegetation patterns would be designed to blend with existing landscape characteristics to maintain the natural character of the landscape. Affected areas would be monitored and revegetated where necessary to minimize bare soil near vistas. Depending on topography, the visual effects from certain vantage points would be improved in the short-term. The following series of photographs depicts a typical stream area before, during, and after P2-floodplain excavation (Figure 3-39).

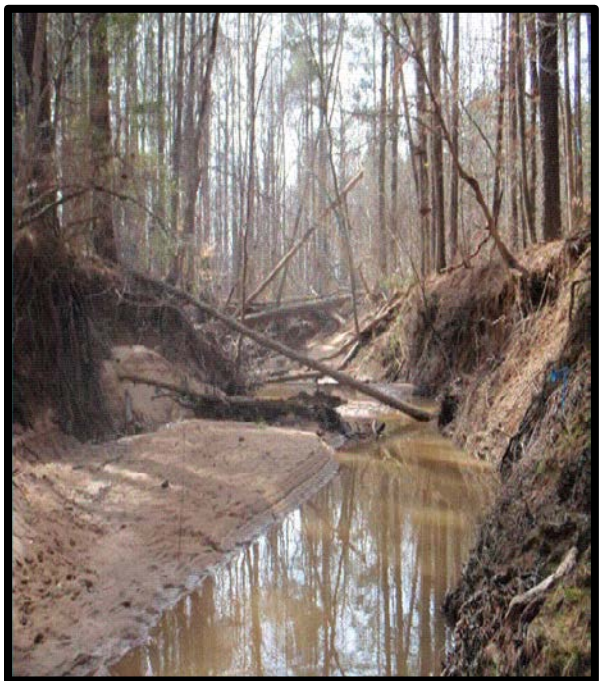
Stream before P2-Floodplain Excavation Restoration

Stream during P2-Floodplain Excavation Restoration

Stream 1 Year after P2-Floodplain Excavation Restoration

FIGURE 3-39: A TYPICAL STREAM AREA BEFORE, DURING, AND AFTER FLOOPLAIN EXCAVATION

The P3-floodplain benches approach would create small benches near the current bankfull elevation. This approach would require less excavation, and the stream restoration work would occur only in defined segments along the stream (a more "surgical" approach); consequently, the stream would be less sinuous than stream segments restored using P2-floodplain excavation. P3-floodplain benches may appear less natural to recreation users; however, visual landforms, such as large rocks and natural materials commensurate with Piedmont characteristics, would be incorporated into the final design. Restored areas would be monitored and revegetated where necessary to minimize bare soil near vistas. The following photographs depict a typical stream before and after the creation of P3-floodplain benches (Figure 3-40).



Stream before P3-Floodplain Benches Restoration

Stream after P3-Floodplain Benches Restoration

FIGURE 3-40: A TYPICAL STREAM BEFORE AND AFTER THE CREATION OF P3-FLOODPLAIN BENCHES

Adhering to mitigation measures described in this Final EIS would reduce many of the adverse effects on scenery. Scenic vistas would be temporarily adversely affected, but would result in no long-term significant impact. Construction activity would result in increased turbidity in local streams; this would be similar to current high flow events in the area and would be temporary. Long-term restoration benefits would include increased access to streams, ability to meet the ROS designations and SIOs, clearer water during storms as the result of reduced erosion, and the addition of riparian plants for visual character. The area is considered highly scenic, and the scenic integrity of the horse trails is highly valued. Alternative 2-Proposed Action would restore the natural character of the area and increase structural and biological diversity.

Construction activity related to the stream restoration would avoid scenic vistas, where practicable. To reduce the duration of the disturbed appearance and the overall visual impact, the final stream restoration design would ensure that root wads, soil borrow, and disposal areas would be placed out of the immediate viewshed (particularly around Forest Service Road 574 and at trailheads). Where feasible, the construction areas would be blended to be subordinate to the existing landscape character in form, color, texture, and line. Disturbed areas adjacent to Forest Service Road 574 would be revegetated with native vegetation, large hardwoods or flowering trees within the immediate foreground viewshed (approximately 300 feet). Existing trail corridor, character trees, and hardwood trees would not be cut unless necessary to mitigate safety concerns, such as hazardous trees that may fall in the trail corridor. Existing signs would be relocated, as needed. Trail crossings would be avoided where possible and would be cleared of any construction debris. Affected trail crossings would be hardened using a variety of Forest Service approved techniques. Trail crossings would be monitored throughout operation and maintenance.

Construction of temporary roads, road reconstruction and soil borrow and disposal areas would also affect scenery. Road construction introduces unnatural visual elements into the landscape and causes contrasts of form, line, color, and texture. Road construction may have either temporary or long-term effects on scenery. Linear clearings would increase visibility into the forest which can create some positive elements but can expose visually disrupted areas (i.e., construction equipment, activities). Temporary roads and skid trails would be blocked with down trees and brush so they are not visible to recreation users. The effects of construction of temporary roads are similar to those of construction of permanent roads initially, but the temporary roads would be closed and revegetated after use. These effects would be less than permanent road construction due to the rehabilitation and growth of vegetation in the temporary road corridors.

Excavation of soil from borrow areas would result in short-term removal of vegetation, and disposal of soil from the restoration activities would cover vegetation temporarily. To reduce the duration of the disturbed appearance and visual effect, borrow and fill areas would be located away from the immediate foreground viewshed, where practical. If these features must be located in the immediate foreground viewshed, bare mineral soil would be revegetated or covered with slash as soon as possible following construction operations. More specifically, soil borrow and fill areas would be positioned outside of the immediate viewshed of trail corridors, including the proposed River Trail (Compartment 7 Stand 5), or at least 50 feet from the trail corridor, where possible. Stream restoration and borrow and fill areas visible to the roads would be broken up spatially (at least 1,000 feet apart), where possible, to avoid large contiguous visible areas of vegetation disturbance along open Forest Service system roads.

Forest Plan Amendment for Scenery

A Project-specific Forest Plan amendment would be required for stream restoration activities. The changes are needed to accomplish the purpose and need as described in this Final EIS. Table 3-30 lists the current Forest Plan standard and the proposed change.

TABLE 3-30: PROPOSED CHANGES TO FOREST PLAN STANDARDS

Current Forest Plan Standard	Proposed Change*
FW-89: The Forest SIOs[1] Maps and SIOs in each prescription governs all new projects (including special uses). Assigned SIO are consistent with the Recreation Opportunity Spectrum management direction. Existing conditions may not meet the assigned SIO.	The SIO would be changed from very high and high to moderate for inventoried scenic classes 1 through 5 for Project activities associated with stream restoration. This would apply to the following management prescriptions in the Project Area: 6.C., 7.D., 7.E.1., 7.E.2., 9.A.3., 9.F., 11 and the Woods Ferry Horse Trail system.

*Note: Specific to this Project only
[1] SIO Scenic Objective Opportunity

SIO changes are needed to accomplish stream restoration and connected actions. Effects of plan amendment changes would be reduced by following Forest Plan standards including BMPs and site-specific mitigation measures.

The disturbance to Project streams and to scenery would be reduced as vegetation recovers. Restored streams would appear heavily disturbed with mostly a grass cover remaining immediately after restoration is completed. During the first few years following restoration, vegetation would consist mostly of early successional species dominated by grasses, forbs and shrubs with scattered trees beginning to become established. Restored streams would appear open and would be highly visible from trails and roads. The contrast between the undisturbed forested area and the restored streams would be readily apparent to the casual observer for the first few years after restoration is completed. Mitigation measures would help to speed the recovery of vegetation and reduce the harsh scenic impacts to the observer. Project activities would still be noticeable approximately five years from stream restoration but a variety of larger shrubs and beginning tree growth should start softening the form, color and texture of the streams and riparian areas. Recovery of tree vegetation consisting mostly of mixed pine and hardwoods along the stream corridor is expected to take between 15 and 25 years. The streams and riparian areas would appear different than other streams in the area and sharp contrasts would still exist in adjacent undisturbed areas. Stream restoration would likely provide some attractive visual settings as stream banks are no longer eroding and caving in and channels are stable in the long-term.

Connected actions associated with the stream restoration would include: soil borrow/disposal areas; temporary roads for hauling dirt to and from stream restoration sites from upland areas; system road reconstruction and maintenance; possible new bridge construction; and merchantable timber removal. Some temporary haul roads would utilize the old woods road system in the area that has been converted to use as a horse trail. This trail system currently has a high SIO that would be changed to moderate. Stream restoration work would be progressive over the next five to ten years and impacts to the trail would not occur all at once. Trees would be cut in these areas and soil disturbance would be evident to the casual user and would detract from the foreground view in these areas. Middle ground and background views would not be impacted by connected actions. Mitigation measures provide

for the reseeding, planting and rehabilitation of these areas. Vegetation recovery along the trail would take between three and five years. Soil borrow and disposal areas and new temporary roads not associated with the current trails would take longer to recover. Again, closing roads from constant use and reseeding to native and desired non-native vegetation would speed recovery efforts and soften scenery impacts. Soil borrow and disposal areas would be replanted with trees and other vegetation to hasten their recovery. The areas would be less evident in approximately five years after disturbance and would provide a more diverse landscape views and visual variety. System road reconstruction, maintenance and possible bridge construction (with the exception of State Road 574) are less visually sensitive to the public. Mitigation measures that stabilize soils and provide for regrowth of vegetation would make these areas less visible within one to three years from completion of restoration activities. Site-specific mitigation measures have been developed to lessen the visual impact from people driving on State Road 574.

RECREATION

Recreation resources are affected by management activities that would alter the recreation experience of forest visitors. Management activities that have the greatest potential to affect recreation are the restoration approaches, the temporary closure of some recreation trails during construction, and the visual impacts of construction and revegetation.

Alternative 2-Proposed Action would result in both short- and long-term effects on the recreation experiences of visitors to the Sumter National Forest Enoree Ranger District. All acres included in Alternative 2-Proposed Action would meet the roaded natural and rural ROS classifications through implementation of site-specific mitigation measures and adherence to Forest Plan standards (Section 2). Restoration areas would be monitored while performing maintenance activities.

Impacts to recreation users would vary depending on the recreation experience sought. Horseback riders and other trail users would be most affected by trail segment closures, the visual impacts of construction, and changes in access to the five existing stream crossings in the Project Area. Trails located in Compartment 9, Stands 3 and 5, in the vicinity of unnamed tributary to Clarks Creek would be most affected during construction. Construction activities would soften the soil near the restoration streams, which would make it difficult for horseback riders to traverse safely through those areas. As such, trails adjacent to restored stream sections may be temporarily closed to trail traffic until the area is stabilized. Sequencing Alternative 2-Proposed Action effectively would allow trail users and visitors to avoid active construction areas by using alternative trails or recreation sites within and outside of the forest. Scheduling construction activities on Little Turkey Creek and the unnamed tributary to Clarks Creek sequentially instead of concurrently would minimize effects on trail users.

The trailhead located off of Forest Service Road 301 C would remain accessible until all stream restoration construction on Little Turkey Creek is complete. The proposed Woods Ferry Horse Trailhead (to be located off of Bucks Grave Road) would remain accessible Friday, Saturday and Sunday during construction. Advanced notices of trail closings would be posted to allow forest visitors to plan recreation activities accordingly.

Using hard-surface material to reconstruct stream crossings would restore and enhance crossings disturbed during construction. Bridges may be used to cross creeks, but water access for horses would still be provided. Horse trails would be cleared of downed trees resulting from stream restoration activities within the Project Area. Affected trail corridors would be mowed during the growing season to reduce vegetation and prevent trails from becoming impassable following restoration.

Increased noise during construction could disrupt visitors' experience over the short-term, especially if construction is audible from a trail or designated recreation area. Increased truck and construction equipment traffic on forest roads could disrupt visitors' travel through the forest, and those using the Woods Ferry and Poulous Loop recreation areas. Hunters would likely have to move to other hunting locations temporarily, which could be on forest, other public or private hunting areas near the Project Area.

Noise disturbances could be alleviated by scheduling construction only on weekdays, where practicable. Moreover, effective sequencing of construction activities would allow recreation users to avoid areas of the forest where construction activities are taking place.

Construction and temporary trail closings could result in a minimal change in use patterns over time. Visitors may choose to recreate at other locations in or near Chester County over the long-term; however, trail closings occur frequently to accommodate other current forest management activities. Many recreation users are familiar with this practice and adjust accordingly. Clear marking of open and closed trails and phased construction would promote recreation in other portions of the forest.

Alternative 2-Proposed Action would increase the diversity of plant species, resulting in a more pleasurable viewing experience over the long-term and benefitting hunters, who depend on edge habitat for species diversity and abundance, and wildlife viewers, who recognize early-succession vegetation to be prime habitat for many song birds and raptors.

In addition to these general effects, some particular effects may differ based upon the type of stream restoration approach, as described in the following paragraphs.

P1-floodplain reconnection would result in a change from a stream with deep, incised channels to a stream that connects with the floodplain, producing an area similar to a wet meadow. This restoration approach would inundate the new floodplain vegetation, which often results in an increase in the number of standing dead trees over the short term. Trees that could fall within the reach of the trail corridor would be monitored, and those determined to be hazardous would be removed by certified chainsaw operators.

Horseback riders probably would not be able to traverse P1-floodplain reconnection areas without affecting vegetation and soils, which would result in long-term damage of restored areas. Stream crossings would be most difficult for horseback riders in an area of P1-floodplain reconnection due to the soft, wet ground. Similarly, hikers and mountain bikers would have a difficult time using trails that are located in a P1-floodplain reconnection area.

Stream crossings probably would be associated only with the P2-floodplain excavation and P3-floodplain benches restoration approaches. If any existing trails or future trails are located in areas of P1-floodplain reconnection, trails would be hardened using a variety of techniques. Water access points would be provided and hardened to protect soil, vegetation, and horses. These areas would be monitored for the effects of off-trail use as part of the Forest Service's routine trail monitoring.

Implementing P2-floodplain excavation would change deep, incised channels to a lower, larger floodplain. This approach would provide positive, long-term scenic benefits for recreation users. Scenic benefits could include the use of rock/boulder materials in stream restoration; the elimination of deep, eroded streambanks; and an overall increase in plant diversity. Water may be more available for horses over the long-term because the stream channel would be more accessible.

Early succession vegetation would grow in restored areas, which would reduce scenic viewing and make certain areas impassible to hikers and other recreation users due to thick undergrowth. Implementing P2-floodplain excavation would require removing large canopy trees, which would reduce shading, making the forest climate warmer and brighter until overhead vegetation re-establishes. Mitigation for these effects would include planting large or fast-growing tree species and monitoring and re-planting species if growth is not occurring. Mowing affected trail corridors during the growing season would prevent trails from becoming impassible following restoration.

The effects of implementing P3-floodplain benches would be similar to the effects of implementing P2-floodplain excavation. Tree removal would be more selective in areas in which the P2-floodplain excavation approach is proposed, which is primarily on the unnamed tributary to Clarks Creek.

Connected actions affecting recreation include the creation of approximately 663 acres of fill and borrow areas, the construction of approximately 12.5 miles of temporary roads, and the production of merchantable timber through stream restoration activities.

Borrow and fill areas would be used for the excavation or disposal of soil needed or produced during restoration activities. To the extent possible, soil borrow and disposal areas would be located away from primary recreation areas, trail heads, and parking areas to minimize short-term aesthetic impacts due to construction noise and the presence of large equipment. Borrow and fill areas would not affect a significant amount of habitat or cause habitat fragmentation that would affect terrestrial wildlife and, consequently, hunting or wildlife viewing over the long-term.

Mitigation would include replanting native, fast-growing vegetation to restore these areas to their previous state. Planting large hardwood or flowering trees along areas visible from roads (such as State Road 574) or designated recreation areas would improve the viewshed. Scheduling construction on weekdays during off-peak seasons (summer and winter) would minimize noise and construction traffic disturbances experienced by visitors to the Project

Area; moreover, locating borrow and fill areas near stream restoration construction would allow recreation users to avoid the areas of the Forest where construction is occurring.

The construction of temporary roads associated with Alternative 2-Proposed Action would increase the recreation value of an area for visitors, such as hunters and hikers, seeking easier access to interior forest areas. The creation of edge habitat along temporary roads could increase wildlife viewing and hunting opportunities for the life of the temporary road (potentially up to 12 years). This alternative would temporarily decrease the recreation value of users seeking a more remote or less roaded condition. Temporary roads would be closed and replanted over the long-term, and temporary bridges would be removed according to Forest Service practices.

Temporary roads could affect horseback riders over the short-term if the temporary roads cross designated trails. Designated trails that cross construction roads would be hardened with material that is safe for horses. Construction operations would be suspended if soil conditions become too saturated. Temporary roads that remain up to 12 years during monitoring and maintenance activities may be perceived to be "trails" and be affected by trail riders. Temporary roads would be closed to trail traffic to prevent damage or use if roads that are being returned to natural, vegetated conditions. This could include blocking temporary roads and skid trails with down trees and brush so they are not visible to recreation users. This would be monitored through special use administration and trail monitoring.

Timber harvest operations associated with implementation of Alternative 2-Proposed Action would result in temporary impacts on recreation. Visitors could be disturbed by increased truck and logging equipment traffic or by operations that are either visible or audible from a designated recreation area. Harvesting operations would increase visibility, access, understory plant development, and wildlife viewing opportunities, which could benefit some users of developed and dispersed recreation areas of the forest. Reduced overhead tree cover could impact some recreation visitors by making the forest climate warmer and brighter until vegetation is re-established.

Impacts would be minimized by ceasing harvesting operations on the weekend, when most recreation users visit the forest, especially during the spring and fall. Replanting harvested areas in accordance with Forest Service BMPs would reduce impacts to recreation visitors over the long-term.

3.13.5 *Cumulative Effects of Alternative 2-Action Alternative (Recreation)*

Cumulative impacts on recreation opportunities in the long-term could occur in the future. As projects are developed, they are individually evaluated for potential effects on recreation resources. If needed, mitigation measures are developed to address concerns and impacts. No long-term cumulative impacts that would affect recreation opportunities are anticipated, but temporary, local effects could occur as individual projects are implemented on the ground. In general, the recreation opportunities on national forest system lands, combined with the potential for activities on private lands, would not exceed the recreation opportunity spectrum designation for these areas in the long term.

3.14 ECONOMICS

3.14.1 *Affected Environment*

The economic analysis used information from *Analyzing the Costs of Design-Bid-Build Projects for Stream Mitigation in North Carolina: Final Report* (Templeton, et. al. 2008). Stream restoration cost information was developed by Ecosystem Planning and Restoration, LLC, and Kleinschmidt Associates. The Forest Service provided cost information for temporary road construction, replacement of four bridges at the Project, reconstruction and periodic maintenance of roads and timber sales, and revenue from the sale of federal timber. The Forest Service "Quick Silver" program was used to conduct the economic analysis.

The analysis focused on the present value of benefits and costs. All benefits and costs are discounted to a common base year for analysis (in this case, expressed in 2014 dollars). The analysis allows for changes in values over a ten-year period due to inflation and the interest rate for borrowing money. The discount rate used for the analysis was 4% and the inflation rate was 1.5%. The net present value is evaluated over the service life of the proposed Project (in this case, a 10-year period). A summary of the analysis is provided here and the complete analysis is contained in the Project file (*2014 Chester County Stream and Riparian Restoration/Enhancement Project Economic Report*).

The Alternative 2-Proposed Action produces other intrinsic public benefits, including but not limited to:

1. significant reductions in stream bank and channel erosion;
2. properly functioning stream systems that are reconnected to their floodplains; and,
3. restored stream and riparian ecosystems.

These benefits are not factored into the economic analysis calculations.

3.14.2 *Direct and Indirect Effects of Alternative 1-No Action*

No costs or revenues would be generated under Alternative 1-No Action.

The Project streams and watersheds would continue to function in a long-term impaired condition as streams continue to adjust from past land use practices in the last century.

3.14.3 *Cumulative Effects of Alternative 1-No Action*

There are no cumulative economic effects from this alternative. Appropriated dollars for forest management on national forest system lands would continue at current levels. Revenue from Forest Service management activities would continue to be realized in the Project Area both in the short- and long-term.

3.14.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

Benefits and costs for Alternative 2-Proposed Action are provided in Table 3-31. Total Project cost does not include Forest Service administrative (overhead) costs to develop and implement the Project. Additional details for each transaction is contained in the Project file (*2014 Chester County Stream and Riparian Restoration/Enhancement Project Economic Report).*

TABLE 3-31: ECONOMIC COMPARISON OF THE ALTERNATIVES

Criterion	Alternative 2-Proposed Action
Investment Length (years)	10
Net Annual Cost ($)	-$2,871,000
Estimated Cost of the Project (Present Net Value) ($)	-$23,283,000
Project Benefits – Revenue from timber received (Present Value Benefits)	$286,000
Total Present Value Costs	-$23,569,000

The Forest Service anticipates that there would be some revenue from timber sales. The Forest Service estimated the total volume of timber (including restoration areas and soil borrow and soil disposal areas) to be 2400 hundred cubic feet (ccf) (Table 3-32). Some merchantable timber would remain in the forest for use in the restoration; however, the amount of the 2400 ccf of timber that could be used in the Project restoration compared to the amount that could be made available for timber sales is not known. Therefore, the revenue from the timber harvest shown in Table 3-31 could decrease.

TABLE 3-32: ESTIMATED TIMBER CUT VOLUMES

Timber Cut Volumes (total)				
Treatments	**Pine ST**	**Pine Pulp**	**HW Pulp**	**Biofuel**
borrow/disposal and restoration sites	2400 ccf	0	0	na

Note:
Pine ST Pine Stand
HW Pulp Hardwood Pulp

Costs ancillary to the Project include reconstruction and maintenance on both Forest Service and state roads. Bridge replacements within the Project Area would likely occur on Project streams due to changes in stream channel widths, elevations and flow dynamics (post-construction). Temporary roads are needed from soil borrow and disposal areas to Project Area streams. Temporary roads would be obliterated and returned to a productive condition once the Project is completed.

3.14.5 *Cumulative Effects of Alternative 2-Proposed Action*

Management activities within the Project Area include agriculture and residential areas on private lands. A majority of the Project Area is in federal ownership (managed by the Forest Service) and is mostly forested. Ongoing management includes road and trail maintenance, management of openings for wildlife benefits, periodic prescribed burning and associated fireline reconstruction, and periodic timber harvest. A Georgia aster and shortleaf pine restoration project is currently planned in the Project Area and implementation would occur in the next 5 years.

Current federal dollars have not been appropriated for this Project. Likely funding would come from completing compensatory mitigation projects upon the National Forest pursuant to a Conservation Land Use Agreement between the USACE and the Forest Service. This agreement provides for compensatory mitigation projects on identified National Forest properties. There are no cumulative adverse economic effects from other activities that would overlap with this Project. Funding for this Project would come from future appropriated funding or as a compensatory mitigation project.

3.15 HUMAN HEALTH AND SAFETY

3.15.1 *Affected Environment*

The FSH, FSM, and the Forest Plan all provide guidance and establish required measures to protect human health and safety during forest management activities. The Sumter National Forest also has a spill response program in place to contain and remove contaminants.

3.15.2 *Direct and Indirect Effects of Alternative 1-No Action*

This alternative would have no effect on human health and safety beyond current management actions in the area. Under Alternative 1-No Action, no stream restoration would occur nor would any improvements to associated roads and bridges. There would be no safety measures put in place since there would be no construction.

3.15.3 *Cumulative Effects of the Alternative 1-No Action*

Past, present and current activities in the area that have the potential to impact human health and safety include prescribed burning, road maintenance and herbicide applications for NNIS plants. All of these activities will comply with Forest Plan direction to protect public health and safety and also include Project-specific design criteria. Adverse cumulative effects are not expected to human health and safety.

3.15.4 *Direct and Indirect Effects of the Alternative 2-Proposed Action*

The effects of Alternative 2-Proposed Action include the actual construction activities during the stream restoration and the connected actions of road reconstruction and maintenance, developing temporary roads and bridges and soil borrow and disposal areas, and harvesting merchantable timber. Commercial timber harvesting activities, temporary road and bridges construction, and maintenance of system roads and wildlife areas would require the use of heavy equipment (e.g., dozers, graders, log loaders, bush-hogs, tractors and trucks). The use of heavy equipment and the movement of trees and logs present the highest potential for safety risks during restoration activities. Cut and leave treatments would require manual

felling of trees by chainsaws. There is risk of injury to contract workers, Forest Service personnel and recreationists. The effects associated with Alternative 2-Proposed Action tier off the effects described in the Final EIS, Vegetation Management in the Coastal Plain/Piedmont (USFS 1989), which analyzes manual, mechanical, herbicide and prescribed burning effects from vegetation management activities.

In accordance with the FSH (6709.11), vegetation management activities, such as revegetation of streams following construction, require all Forest Service workers to wear safety equipment, including hard hats, eye and ear protection, chaps, and fire retardant clothes. Compliance with the Forest safety code would be accomplished through on-site inspections and reviews of accident reports. For all mechanical treatments, equipment operators must demonstrate proficiency with the equipment and be licensed to operate it. In addition, an assistant must direct the operator if safety is compromised by terrain or limited sight distances.

The private timber sale contractor conducting the harvest would be responsible for adhering to safety specifications during the entire harvest process.
These requirements include the:

- installation of temporary traffic control devices on roads and trails open to public travel to warn users of hazardous or potentially hazardous conditions;
- removal of logging slash from all trails open to the public;
- development of a specific traffic control plan; and,
- installation of road closure devices, such as but not limited to barricades to control entry to the activity site (USDA, 2000a).

Any risks to workers or the public would be minor and temporary. Strict adherence to safety measures would minimize or eliminate adverse human health and safety effects.

Road maintenance would improve safety conditions for Forest personnel and users during Project activities. While this would have a beneficial effect on human health and safety, this effect would not be significant.

3.15.5 *Cumulative Effects of Alternative 2-Proposed Action*

Past, present, and future actions in and adjacent to the Project Area would comply with established standards, guidelines and design criteria in the Forest Plan. Implementing other management actions over several years designed to achieve desired conditions in and around the Project Area, would not increase the potential for cumulative, adverse safety impacts. With strict adherence to required safety measures, no significant, cumulative impacts on human health and safety would occur, regardless of the type and amount of activity conducted.

The Forest Service conducts prescribed burning in and adjacent to the Project Area as part of its normal maintenance and general management of the Sumter National Forest. Threats to human health and safety during a prescribed fire are smoke inhalation and injury from the fire itself in the event that a controlled burn escapes the area. Various safety measures are in place to protect workers and the public from adverse effects during prescribed fires. A

prescribed fire plan is required for each managed burn, which includes a smoke mitigation plan in the event that planned conditions change. Roads and highways are closed if the smoke impairs visibility enough to threaten public safety. The public is notified through signs and closed roads, if necessary, and nearby residents adjacent to the Forest are notified prior to a prescribed burn. In addition, standards and guidelines and mitigation measures provided in the Forest Plan are adhered to during prescribed fires, which minimize or eliminate public human health and safety concerns resulting from smoke exposure and fire injuries. All burns are conducted by trained staff, supervised by an experienced burn boss, and monitored through review of burn plans, on-site inspections, and post-burn evaluations.

3.16 ENVIRONMENTAL JUSTICE AND THE PROTECTION OF CHILDREN

3.16.1 *Affected Environment*

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, requires federal agencies to identify and address any disproportionate adverse human health or environmental effects of its projects on minority or low-income populations. Each federal agency must conduct its programs, policies, and activities that substantially affect human health or the environment in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons or populations from participation in, denying persons or populations the benefits of, or subjecting persons or populations to discrimination under, such programs, policies, and activities because of their race, color, national origin, or income level.

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, directs federal agencies to "identify and assess environmental health risks and safety risks that may disproportionately affect children." This Executive Order requires federal agencies to "ensure that [their] policies, programs, activities, and standards address disproportionate risks to children."

Demographic information was compiled using the Economic Profile System-Human Dimensions Toolkit (EPS-HDT) to produce socioeconomic reports for Chester County, South Carolina. Chester County includes the following county sub-divisions: Chester West, Chester, Fort Lawn, Great Falls, and Richburg. EPS-HDT used published statistics from federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureaus of Labor Statistics, U.S. Department of Labor. The reports are contained in the Project record.

An examination of environmental justice sets the stage for whether the action alternatives or Alternative 1-No Action alternative would pose disproportionate environmental, health, or safety risks to children, minorities, or low-income people or families.

The Project is located on the Enoree Ranger District which is located within Chester County, South Carolina. Table 3-33 and Table 3-34 list the racial makeup and poverty levels, respectively, of the population in the county subdivision region as compared to the State of South Carolina. The percent of individuals and families living below the poverty level is higher in Chester County than in all of South Carolina (16.6 and 13.2 percent, respectively)

and significantly higher than individuals and families below poverty in the U.S. (14.9% and 10.9%, respectively).

TABLE 3-33: RACIAL MAKEUP IN CHESTER COUNTY SUBDIVISION REGION AS COMPARED TO SOUTH CAROLINA

Demographics	County		South Carolina	
Total	33,028	%	4,630,351	%
White alone	19,709	59.7%	3,108,466	67%
Black or African American alone	12,532	37.9%	1,290,704	29.9%
American Indian alone	196	0.6%	15,122	0.3%
Asian alone	76	0.2%	57,635	1.2%
Native Hawaiian & Other Pacific Island alone	5	0.0%	1,791	0.0%
Some other race alone	45	0.1%	75,211	1.6%
Two or more races	465	1.4%	81,422	1.8%

TABLE 3-34: POVERTY LEVELS IN CHESTER COUNTY SUBDIVISION REGION AS COMPARED TO SOUTH CAROLINA

Poverty Levels	County		South Carolina	
People Below Poverty	7,814	24%	787,788	17.6%
Families Below Poverty	1,758	20.5%	157,553	13.2%

3.16.2 *Direct and Indirect Effects of Alternative 1-No Action*

No stream restoration activities and associated connected actions would occur under Alternative 1-No Action. There would be no activities occurring under this alternative that would adversely impact residents, minorities, children, people, or families at or below the poverty level or forest users. Therefore, an environmental just analysis is not required.

3.16.3 *Cumulative effects of Alternative 1-No Action*

There are no anticipated cumulative effects for Alternative 1-No Action.

3.16.4 *Direct and Indirect Effects of Alternative 2-Proposed Action*

Table 3-33 and Table 3-34 show that there are slightly higher minorities in Chester County as compared to the state; however, the majority of the Project Area is within the Forest and does not overlap with communities with high populations of minorities. In addition, the number of people and families living at or below poverty level is higher in Chester County than the State of South Carolina. Additional environmental justice analysis is not warranted because the Project Area does not have any impact on minority or at or below poverty level communities.

Noise generated during construction may disturb residents located near forest system roads and forest users, although these impacts would be local and temporary. Additional traffic would occur on state, county, and local roads, both within and outside of the forest potentially impacting residents. The restoration activities and connected actions would not disproportionately affect minorities, children, or to people or families at or below the poverty level assuming adherence to the Forest Plan standards; therefore, an environmental justice analysis is not required.

3.16.5 *Cumulative Effects of Alternative 2-Proposed Action*

Past, present, and reasonably foreseeable projects in or near the Project Area on federal land would not have cumulative disproportionate impacts on minorities, children, or people living at or below the poverty level.

3.17 CIVIL RIGHTS

3.17.1 *Affected Environment*

The Forest Service participates in special programs to enhance opportunities for equal participation of women, minorities, and the handicapped (FSM 1761 and 1762).

3.17.2 *Direct and Indirect Effects of Alternative 1-No Action and Alternative 2-Proposed Action*

Individual civil rights and rights of minority groups would not be adversely affected directly or indirectly by the alternatives and associated connected actions. Women, Native Americans, and minority groups would not be impacted by any of the alternatives any differently than any other groups.

Implementing Alternative2-Proposed Action and associated connected actions would not affect potential participation as contractors or subcontractors by small business, minority-owned or small, disadvantaged businesses, and women-owned business concerns in contracts, grants, and cooperative agreements.

3.17.3 *Cumulative Effects of Alternative 1-No Action and Alternative 2-Proposed Action*

There have been no identified or documented instances of management actions adversely affecting civil rights from past, present or future activities on either federal or private lands. There are no barriers to equal access by minorities and handicapped people in the Project Area or as a result of past, present or future activities management actions. There are no past or present evidence of discriminatory practices in the locale or with any of the alternatives developed.

3.18 OTHER ELEMENTS

3.18.1 *Irreversible and Irretrievable Commitment of Resources*

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species, the destruction or removal of cultural resources or the removal of mined ore. Irreversible commitments of resources are permanent losses of non-renewable resources.

Irretrievable commitments are those that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road. Irretrievable commitments of resources are temporary losses of renewable resources.

There are no irreversible commitments of forest resources by implementing this Project. The irretrievable commitment of resources for Alternative 2-Proposed Action includes the temporary loss of productive timber and vegetation from the restoration activities and associated construction. Productivity is expected to return upon completing the Project and revegetation of riparian, construction, and soil and borrow areas.

3.18.2 *Rivers Eligible for Inclusion in the National Wild and Scenic River System*

There are no eligible rivers in the Project Area.

3.19 OTHER REQUIRED DISCLOSURES

3.19.1 *Principal Environmental Laws*

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare Draft and Final EISs concurrently with and integrated with other environmental review laws and executive orders." Alternative 2-Proposed Action must comply with environmental laws, as well as direction provided to agencies through executive orders. The Forest Service has consulted with the USACE, USFWS, SHPO and SCFC. In addition to the above named agencies, the Forest Service sent copies of this Final EIS to SCDHEC and SCDNR.

Clean Air Act

Effects to air are disclosed in Chapter 3, Section 3.4 in this Final EIS. Project impacts are minor and of short duration being associated mostly with release of vehicle emissions and dust during Project activities. The small increases in carbon dioxide would not measurably contribute to global climate change given the limited number of acres to be impacted. Restored vegetation within the Project Area would continue to utilize carbon dioxide from the atmosphere in an amount that equals or exceeds the amount released from the Project. Air quality would continue to be monitored on the forest and district and results reported in the annual Sumter National Forest monitoring report.

National Historic Preservation Act

The South Carolina SHPO, Catawba Indian Nation THPO, and the ACHP were notified about the Project in letters dated July 2, 2014. The Forest Service intends to comply with Section 106 of the Historic Preservation Act (NRHP) through the use of a phased approach in the identification of historic properties and any adverse effects from the Project. Because the effects on historic properties cannot be fully determined prior to approval of the undertaking, the Forest Service will execute a Programmatic Agreement to govern the implementation of this Project in accordance with 800.14 (b) of the implementing regulations. The Programmatic Agreement provides a process for future survey and determination of National Register eligibility of all sites in the APE. This Final EIS is guided by direction found in A Handbook for Integrating NEPA and Section 106 (Council on Environmental Quality 2013).

The SHPO, Catawba Indian Nation THPO, and the ACHP will be consulted and will be signatories to the Programmatic Agreement.

National Forest Management Act

The National Forest Management Act requires projects to be consistent with the Forest Plan and to make the following findings [16 U.S.C. 1604 (g)(3)(E)(F) and (m)]:

1. Soil, slope, or other watershed conditions will not be irreversibly damaged.

   The effects on soils (Section 3.2) and hydrology (Section 3.3) are disclosed in Chapter 3 of this Final EIS. Mitigation measures are included in Section 2.4 of the Final EIS to reduce or minimize adverse effects to soils and hydrology during Project activities. Site-specific monitoring is identified in Section 2.4 of the Final EIS to evaluate impacts to soil and water from Project activities to ensure impacts are within direction established in the Forest Plan. As disclosed in the Final EIS, there are significant reductions in stream bank erosion and sedimentation from implementation of Alternative 2-Proposed Action which would have long-term benefits to the physical, biological, and social environments.

2. There is assurance that such lands can be adequately restocked within five years after harvest.

   Areas cleared for soil borrow and soil disposal would be restored to productivity by planting trees consisting of, but not limited to, shortleaf and loblolly pine to full stocking levels. Hardwoods may also be planted where suitable sites exist. Effects on vegetation are disclosed in Section 3.7.

3. Protection is provided for streams, stream banks, shorelines, lakes, wetlands and other bodies of water from detrimental changes in water temperatures, blockages of water courses and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat.

   Effects to water, riparian areas, streams, streambanks, wetlands and floodplains are disclosed in Sections 3.2 and 3.3 of the Final EIS. Effects to aquatic resources are disclosed in Section 3.11. Forest Plan standards including *South Carolina's Best Management for Forestry and National Best Management Practices for Water Quality Management on National Forest System Lands*, collectively referred to as BMPs and site-specific mitigation measures (Section 2.4) are included to provide protection to streams, reduce effects of sediment and protect aquatic communities. The Project would result in significant reductions in streambank and channel erosion and reconnect streams to their floodplains.

3.19.2 *Executive Orders*

The following executive orders provide direction to federal agencies.

- Invasive Species, Executive Order 13112 of February 3, 1999. See Chapter 3 and mitigation measures in Chapter 2 of the Final EIS. Effects were analyzed in Section 3.7, Chapter 3 of the Final EIS.
- Migratory Birds, Executive Order 12962 of January 10, 2001. Effects were analyzed in Section 3.10, Chapter 3 of the Final EIS.

- Environmental Justice, Executive order 12898 of February 11, 1994. This order requires an assessment of whether implementation of this decision would disproportionately affect minority or low-income populations. See Chapter 3 of the Final EIS.

3.19.3 *Special Area Designations*

There are no inventoried roadless areas, wilderness, wilderness study areas, or Wild and Scenic rivers. There are no rivers eligible for the National Wild and Scenic River System within the Project Area.

3.19.4 *Federal, Regional, State and Local Land Use Plans, Polices and Controls*

Implementation of the Forest Plan including BMPs and Project specific mitigation measures described in Chapter 2 would result in the proposed activities being in compliance with federal and state plans, policies, and controls. The USACE, Charleston District and the Francis Marion and Sumter National Forests have entered into a Conservation Land Use Agreement (July 2013) for the restoration or enhancement of aquatic resources on national forest system lands.

3.19.5 *Energy and Natural or Depletable Resource Requirements and Conservations Potential*

Potential Consumption of fossil fuels would occur with the action alternatives during restoration activities, timber hauling as well as temporary road maintenance, and Project maintenance and monitoring activities. There are no unusual energy requirements associated with Alternative 2-Proposed Action nor is it the type of proposal that provides an opportunity to conserve energy at a large scale. Wood is a renewable resource and the amount of timber being removed is not substantial. With the proper application of Forest Plan standards and implementation of mitigation measures described in Chapter 2 for soils, water, wildlife, forest vegetation and other resources, the Project would conserve resources.

3.19.6 *Urban Quality, Historic and Cultural Resources and the Built Environment*

Historic and cultural resources would be protected as described in Chapter 3, cultural resources. A Programmatic Agreement would be implemented for protection of historic properties in the Project Area as well as any new ones that are discovered. The South Carolina SHPO; Catawba Indian Nation THPO, and the Advisory County would be signatories to the Programmatic Agreement.

3.19.7 *Travel Analysis Process Report*

A TAP has been completed following procedures found in FSH 7709.55 and was used in the decision on management of roads in the analysis area. The TAP is located in the Project file (*2014 Francis Marion and Sumter National Forest Travel Analysis Process report*).

3.20 SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and

promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Under the Multiple-Use Sustained Yield Act and the National Forest Management Action, all renewable resources are to be managed in such a way that they are available for future generations. Timber harvesting can be considered a short-term use of a renewable resource. As a renewable resource, trees can be reestablished and grown again if long-term soil productivity is maintained through application of mitigation protection measures described in Chapter 2.

The proposed stream restoration and associated activities would require removal of some forest products in the short-term (1-5 years) and generate some revenue for the federal government. The state and local economy would see benefits in the form of business and employment taxes. Treatment activities and resulting forest products would directly support jobs in the stream restoration, soil hauling, and forest products industries. Existing and temporary roads would be used to access the four watersheds during the timeframe for the Project restoration. When restoration has been completed, system road use would return to the status quo on most roads. Road reconstruction and maintenance activities would improve road conditions both for the contractors and for the public driving on these roads. Benefits would exist for some time after restoration activities are complete. There would be a short-term loss of soil productivity on areas dedicated to log landings, soil borrow and soil disposal. Dust and air pollutants would be created in the Project Area, but would disperse quickly and not impact long-term air quality. Temporary roads would be closed and restored to as natural a condition as possible. They would be water-barred and re-seeded with grass to reduce erosion and trees would be allowed to grow on them.

Restored streams would provide higher functional lift in each of the five categories: hydrology, hydraulics, geomorphology, physicochemical, and biology over the long term (7-15 years). The streams would become more stable, restoring the hydrologic regime including reconnecting streams to their respective floodplains, reducing sedimentation and stabilizing banks, improving in-stream and riparian habitats, and improving water quality.

Stream restoration would benefit aquatic habitat, wildlife, recreation users, and scenic resources. Revegetated sections within the Project Area would increase the variety of native and non-invasive species that eventually provide forest canopy and scenic foreground. Regeneration harvest and woodlands would also benefit wildlife and understory plants. Establishment and maintenance of woodland habitat would provide additional habitat diversity for a variety of disturbance-dependent, early successional game and nongame wildlife species in all stages of their lifecycles. Effects on PETS, MIS, migratory birds and aquatic communities are discussed in Chapter 3.

3.21 UNAVOIDABLE ADVERSE EFFECTS

Implementation of any of the alternatives, including Alternative 1-No Action, could cause adverse environmental effects that cannot be fully mitigated or avoided. These are discussed by resource area throughout Chapter 3. Unavoidable adverse impacts often result from

managing the land for one resource at the expense or condition of other resources. Some adverse effects are short-term and necessary to achieve long-term beneficial effects. The application of Forest Plan standards including BMPs, along with site-specific mitigation measures are intended to limit the extent, severity and duration of potential impacts.

Alternative 1-No Action would have an adverse effect on forest health, stream stability and erosion rates, and aquatic habitats in the long-term. Bank erosion would continue at its current rate as described in Table 3-3 creating additional instability and loss of stream function.

Alternative 2-Proposed Action would result in short-term impacts to aquatic and terrestrial habitats during construction. Some aquatic organisms that cannot move quickly to another wetted area may be covered by machinery or soil fill during the stream restoration. There would be short-term increases in sediment concentrations and disturbance in riparian areas. There would be temporary disturbance to wildlife and to recreation as activities and traffic would increase. Hikers, backpackers, horseback riders, anglers and hunters could be temporarily displaced during stream restoration activities Site- specific mitigation measures found in Chapter 2 would reduce impacts. Short-term impacts to scenery would result from cut trees, construction equipment, and soil disposal and borrow areas. Adherence to Forest Plan standards, including BMPs and site-specific mitigation measures would reduce and limit the duration of effects to sediment concentrations, effects on aquatic and terrestrial organisms, recreation users, and general disturbance in riparian areas.

Mitigation measures address impacts to scenery, recreation and cultural resources. Chapter 3 of this Final EIS and associated Project file provide more detailed information on unavoidable adverse impacts.

Threatened and endangered species were analyzed for this Project. Alternative 2-Proposed Action is not likely to adversely affect Georgia aster and Bald eagle nest and communal roost sites. A detailed discussion of the adverse effects is found in the threatened and endangered wildlife species section of Chapter 3 and in the BA/BE. Alternative 2-Proposed Action includes mitigation measures to minimize disturbance to individual plants and to the Bald eagle. Mitigation measures are listed in Chapter 2.

Project impacts on sensitive wildlife and plant species were also analyzed. Alternative 2-Proposed Action may impact individuals, but is not likely to result in a trend towards listing or loss of viability for the Georgia aster or Bald eagle or adversely affect potential habitat that exists for indigo bush, lanceleaf trillium, nodding trillium, Piedmont aster, sweet pinesap and wood stork. Discussion of effects to these species can be found in the sensitive species section in Chapter 3 and in the BA/BE.

Soil disturbance would be evident from the restoration activities and connected actions. Alternative 1-No Action and Alternative 2-Proposed Action would have long- and short-term direct negative effects on forest soils. Effects to soils include: compaction, rutting and displacement, disturbed litter layer and soil organic matter. Discussion of the adverse effects to soils can be found in the soils section of Chapter 3. By implementing the mitigation

measures in Chapter 2 and Forest Plan standards, including BMPs, impacts to soils would be minimal, and in fact, effects would be beneficial.

Alternative 2-Proposed Action would increase sunlight and soil disturbance to the forest floor which has the potential to spread or increase already existing populations of NNIS in the Project Area. Mechanical equipment, materials, and seeds used for soil stabilization could inadvertently bring in seeds of invasive plants. Mitigation measures listed in Chapter 2 would minimize NNIS from spreading or getting established. Stream restoration construction contract provisions require the cleaning of equipment to prevent the spread or introduction of NNIS from other areas. These actions would ensure that the purpose and need for the Project can be achieved by controlling the spread of existing populations of NNIS and introduction of new NNIS into the Project Area. Additional discussion on NNIS can be found in the invasive plants section of Chapter 3.

Treatment activities and burning would impact air quality through equipment emissions and dust; however, Project impacts are expected to still meet state and federal air quality standards. Additional discussion on air quality impacts can be found in the air quality section of Chapter 3.

CHAPTER 4. CONSULTATION AND COORDINATION

4.1 PREPARERS AND CONTRIBUTORS

The Forest Service consulted the following individuals during the development of this Final EIS.

4.2 FOREST SERVICE ID/CORE TEAM MEMBERS

Jim Bates

Position	Sumter Zone Archeologist
Education	MA, Anthropology, University of Tennessee (1982) BA, Anthropology, University of Georgia (1975)
Experience	38 years professional experience, Archeology
EIS Contribution	Cultural Resources, Resource Identification, Effects Analysis, Other Elements section, Document Review, IDT Coordination

Larue Bryant

Position	Forest Engineer (Supervisory Civil Engineer)
Education	BS, Civil Engineering, Clemson University (1991)
Experience	22 years professional experience
EIS Contribution	Transportation Infrastructure-Planning and Analysis

Robbin Cooper

Position	Landscape Architect
Education	BLA, Bachelor of Landscape Architecture, Louisiana State University, (1989)
Experience	24 years professional experience
EIS Contribution	Review of Recreation and Scenery Sections

Christopher Evans

Position	Resources Assistant, Enoree Ranger District
Education	BS, Marshall University, 1997
Experience	13 years with U.S. Forest Service
EIS Contribution	Document Review/Comment

William Hansen, P.H.

Position	Formerly Forest Hydrologist (currently hydrologist contractor)
Education	BS, Forestry and MS Forestry (Hydrology), University of Missouri, School of Forestry, Fisheries and Wildlife, Columbia, Missouri.
Experience	43 years professional experience
EIS Contribution	Subject Matter Expert reviewed and contributed to sections on water related subjects including Riparian, Floodplains, and Wetlands, Hydrology, Estimates of Stream Types, Erosion, Sediment and Water Quality Effects by Hydrologic Scale, Associated Standards/BMPs/ Mitigation, extended IDT member

Geoff Holden

Position	Forest GIS Coordinator
Education	BS, Forestry, Northern Arizona University (1999); Masters in Geographic Information Systems, University of Minnesota (2003)
Experience	11 years professional experience
EIS Contribution	Maps; Geospatial Analysis for Soil/Water Cumulative Effects

Jason Jennings

Position	Forest Soil Scientist
Education	BS, Forest Resource Management, College of Agriculture, Forestry and Life Sciences, Clemson University (2003), Master of Forest Resources (MFR), College of Agriculture, Forestry, and Life Sciences, Clemson University (2005)
Experience	8 years professional experience
EIS Contribution	Soil Resource Section

Jim Knibbs

Position	Forest Environmental Coordinator
Education	BS, Resource Management, College of Environmental Science and Forestry, Syracuse University (1975)
Experience	36 years professional experience
EIS Contribution	Portions of the Social Analysis, Economic Analysis and Other Elements section, Document Review/IDT Coordination

Robin Mackie

Position	Forest Botanist/Ecologist
Education	MS Forest Resources, University of Georgia; BS Biology Berry College
Experience	23 years of experience with the Forest Service
EIS Contribution	Ecological Communities and Non-Native Invasive Plant Species, TES Review

Jeff Magniez

Position	Zone Wildlife Biologist
Education	BS, Wildlife Management, Humboldt State University (1996)
Experience	17 years professional experience
EIS Contribution	MIS and PETS Sections, Biological Assessment/Evaluation

Carrie Miller

Position	Biological Science Technician
Education	BS, Forestry, University of Kentucky (2002)
Experience	8 years Forester Experience and 4 years wildlife and biology experience
EIS Contribution	Vegetation Section

Alice Riddle

Position	Outdoor Recreation Planner
Education	BS, Outdoor Recreation, Northern Michigan University
Experience	24 years Forest Service Career, 22 years in Recreation Program (Recreation Technician & Outdoor Recreation Planner)
EIS Contribution	Recreation and Scenery

Jeanne Riley

Position	Forest Fisheries Biologist
Education	MS, Fisheries Science, University of Tennessee, Knoxville, TN 1986
Experience	28 years professional experience
EIS Contribution	Aquatic Analysis

David White

Position	Contract Ecologist/Botanist for Francis Marion Sumter National Forest
Education	BS, Wofford College; MS Botany, University of Georgia
Experience	18 years as Forest Service Ecologist; 10 years as contractor
EIS Contribution	Ecological Communities, Old Growth, Invasive Plant Species, Restoration, Rare Plants; extended ID Team member

4.3 OTHER PREPARERS

Erin Bennett, E.I.

Position	Water Resources Specialist
Education	MS, Biological Engineering, North Carolina State University (2013)
Experience	2 years of professional experience
EIS Contribution	Soil and erosion analysis and development of proposed action

Shane Boring

Position	Environmental Scientist
Education	MS, Ecology - Rutgers University (2001); BS, Biology-University of SC
Experience	15 years research, regulatory and consulting experience
EIS Contribution	Botanical, Wildlife, PETS, Migratory Birds Affected Environment and Analysis

Sue Byrd

Position	Document Manager/Editor
Education	Florida Community College
Experience	30 years professional experience
EIS Contribution	Document Configuration, Compilation, Editing, Formatting

Carol DeLisle

Position	Technical Writer and Editor
Education	BA, Biological Science, University of Maryland Baltimore County (1988)
Experience	20 years professional experience
EIS Contribution	Portions of Affected Environment, general technical editing of all sections

Amanda Fleming

Position	Scientist
Education	MS, Environmental Management, Troy University; BS, Environmental Science, Auburn University
Experience	13 years professional experience
EIS Contribution	Scenic and Cultural Resources

Will Harman, P.G.

Position	Senior Fluvial Geomorphologist
Education	MA, Geography and Earth Science, University of North Carolina at Charlotte (1996)
Experience	23 years of professional experience
EIS Contribution	Soil and Erosion Analysis and Development of Proposed Action

Henry Mealing

Position	Asst. Project Manager – Fisheries Biologist
Education	MS, Fisheries Management, Forestry, Wildlife, and Fisheries, University of Tennessee (1989)
Experience	27 years of professional experience
EIS Contribution	Portions of the Water Resources, Aquatics, Geology, and Soils and other various elements section reviews

Alison Jakupca

Position	Regulatory Coordinator
Education	B.S. Wildlife, Aquaculture and Fisheries, Clemson University (2004)
Experience	10 years professional experience
EIS Contribution	Scenic and Recreation Sections

Zachary Nixon

Position	Data Analyst
Education	MEM, Duke University (2006)
Experience	18 years professional experience
EIS Contribution	Visualization and Spatial Data Analysis

Morris Perot

Position	Senior Environmental Scientist
Education	MS, Natural Resources and Environment, University of Michigan (1998); BS, Biology and Environmental Studies, St. Lawrence University (1990)
Experience	21 years professional experience
EIS Contribution	Geomorphology, Geology and Soils, Aquatic Ecology

Kelly Schaeffer

Position	Project Manager, Senior Regulatory Advisor
Education	MS, Recreation and Resource Management, Pennsylvania State University 1991; BS, Recreation Resources Management, University of Maryland (1986)
Experience	23 years professional experience
EIS Contribution	Project Manager, overall document review, Socioeconomics, Environmental Justice

Kevin Tweedy, P.E.

Position	Senior Water Resources Engineer
Education	MS, Biological and Agricultural Engineering, North Carolina State University (1998)
Experience	16 years of professional experience
EIS Contribution	Soil and Erosion Analysis and Development of Proposed Action

4.4 DISTRIBUTION OF THE ENVIRONMENTAL IMPACT STATEMENT

The Final EIS will be distributed to the following government agencies as well as those organizations and individuals that submitted comments during the scoping period or requested a copy.

Joe Armstrong
Richard Baker
Frank Bell
Donnie Burris
Ed Cole Jr.
Richard Darden – United States Army Corps of Engineers
Jon Durham
Mark Griffin - South Carolina Department of Health & Environmental Control
Marvin Grant
E. Grayson
Angie Grooms – NRG
Byron Hamstead – United States Fish and Wildlife Service
Chuck Hightower - South Carolina Department of Health & Environmental Control
Ron Holt
Jason Johnston – South Carolina Department of Transportation
Charlie Johnston – Duke Energy
Frank Kimbrell
Mike Kinsey
Chris McAllister
Greg Mixon - South Carolina Department of Natural Resources
Frank & Jill Morrison
Dr. Daniel Richter
John Rogers
Ross Self – South Carolina Department of Natural Resources
Debbie Shugart
Ziedonis Sils
Paul Snead-Duke Energy
Tom Strait
U.S. Environmental Protection Agency, Region 4, EIS Review Coordinator
Advisory Council on Historic Preservation, Director Planning and Review
Debbie Wade
Rick Walker
Josh Warren - Duke Energy
Holly Welch – South Carolina Forestry Commission
Rusty Wenerick – South Carolina Department of Health & Environmental Control
Morgan Wolf – United States Fish and Wildlife Service

4.5 OTHER STATE AGENCIES

The Final EIS was sent or made available to the South Carolina Forestry Commission, Columbia, SC and the South Carolina Department of Health and Environmental Control, Columbia, SC.

4.6 FEDERAL AGENCIES

The following federal agencies received the Final EIS by hard copy, CD and/or a one page Executive Summary of the Project, including a contact name and number and a Web site address where the full document is posted:

- Director, Planning and Review, Advisory Council on Historic Preservation
- Deputy Director, APHIS PPD/EAD
- National Environmental Coordinator, NRCS
- Acquisitions and Serials Branch
- NOAA Fisheries Services SE Region, St. Petersburg, FL
- U.S. Army Corps of Engineers, Atlanta, GA
- EPA Office of Federal Activities, Atlanta, GA
- Director, Office of Environmental Policy and Compliance
- U.S. Coast Guard, Department of Homeland Security
- Regional Director, Federal Aviation Administration, Southern Region
- Division Administrator, Federal Highway Administration, Columbia, SC
- Director, NEPA Policy and Compliance, DOE

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GLOSSARY

Commonly Used Acronyms

Advisory Council	Advisory Council on Historic Preservation
AFS	American Fisheries Society
APE	Area of Potential Effect
ATKINS	Atkins, Inc.
BA	Biological Assessment
BANCS	Bank Assessment for Non-point Source Consequences of Sediment
BCR	Bird Conservation Region
BE	Biological Evaluation
BEHI	Bank Erosion Hazard Index
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practices
Brockington	Brockington and Associates, Inc.
CEQ	Council on Environmental Quality
ccf	Million Cubic Feet
CFR	Code of Federal Regulations
CMP	Compensatory Mitigation Plan
CO	Carbon Monoxide
COR	Contracting Officer Representative
DA	Department of the Army
Duke Energy	Duke Energy Carolinas, LLC
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPS-HDT	Economic Profile System-Human Dimensions Toolkit
EPT	Ephemeroptera, Plecoptera, and Trichoptera
FB	Floodplain Benches
FE	Floodplain Excavation
FEMA	Federal Emergency Management Agency
Forest Plan	2004 Revised Land and Resource Management Plan, Sumter National Forest
Forest Service	U.S. Forest Service
FR	Floodplain Reconnection
FSH	U.S. Forest Service Handbook
FSM	U.S. Forest Service Manual
FW	Fresh Water
GHG	Greenhouse Gas
HUC	Hydrologic Unit Code
IDT	Interdisciplinary Team
IPCC	Intergovernmental Panel on Climate Change
Lee Nuclear Station	William States Lee III Nuclear Station
MIS	Management Indicator Species
NAAQS	National Ambient Air Quality Standards
NABCI	North American Bird Conservation Initiative

NBS	Near-bank Stress
NCDENR	North Carolina Department of Environment and Natural Resources
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NGVD	National Geodetic Vertical Datum
NNIS	Non-native Invasive Species
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOx	Nitrogen Oxides
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
OHV	Off-highway Vehicle
PA	Programmatic Agreement
PETS	Proposed, Endangered, Threatened, and Sensitive Species
ppm	parts per million
Project	Chester County Stream and Riparian Restoration/Enhancement Project
Project Area	Approximately 18 miles of streams within four watersheds within the Enoree Ranger District of Sumter National Forest
Revised Predictive Models	Cultural Landscape Overview and Predictive Model
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
Rule	USACE Final Mitigation Rule 1
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCDOT	South Carolina Department of Transportation
SCFC	South Carolina Forestry Commission
SCSCO	South Carolina State Climatology Office
SFHA	Special Flood Hazard Area
SHPO	State Historic Preservation Office
SIO	Scenic Integrity Objective
SWPPP	Stormwater Pollution Prevention Plan
TACCIMO	Template for Assessing Climate Change Impacts and Management Options
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDHS	U.S. Department of Homeland Security
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
UT	Unnamed Tributary

DEFINITIONS

Affected environment - The current environment that may be affected by implementation of an alternative. Also, a chapter heading in environmental documents.

Air pollutant - Any substance in air that could, if in high enough concentrations could harm humans.

Air quality - The composition of air with respect to quantities of pollution therein; used most frequently in connection with "standards" of maximum acceptable pollutant concentrations.

Alternative - In an environmental document, one of several possible options for responding to the purpose and need for action.

Analysis area - Area used in a resource area for affected environment condition description and environmental consequences discussions. May or may not be the same area of consideration as the "Project Area".

Best Management Practices (BMPs) - A practice or combination of practices that are the most effective and practical (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

Biodiversity - The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

Biological Assessment (BA) - A Forest Service process that provides an analysis of the potential effects on species classified as threatened or endangered by the U.S. Fish & Wildlife Service. Used to provide a process and standard by which to ensure that listed species receive full consideration in the decision making process.

Biological Evaluation (BE) - A Forest Service process that provides an analysis of the potential effects on species of animals, fish and plants classified as “Sensitive” by the Regional Forester. Used to provide a process and standard by which to ensure that sensitive species receive full consideration in the decision making process.

BMP - see Best Management Practices.

Climate change - A significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions, or in the distribution of weather around the average conditions (i.e., more or fewer extreme weather events).

Cultural resource - The remains of sites, structures, or objects used by humans in the past - historical or archaeological.

Cumulative effects - The effects on the environment that results from the incremental impact of the action when added to other actions. Cumulative effects can also result from individually minor but collective, individual actions over a period.

Direct effects - Environmental consequences as a result of a proposed action, which are caused by the action and occur at the same time and place.

Ecosystem - A spatially explicit, relatively homogeneous unit of the earth that includes all interacting organisms and components of the abiotic environment within its boundaries.

Effects - Environmental consequences because of a proposed action. Included are direct effects, which are caused by the action and occur at the same time and place, and indirect effects, which are caused by the action and are later in time, or further removed in distance, but which are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern or land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems.

EIS - See Environmental Impact Statement.

Endangered species - Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plants or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.

Environmental consequence - The result or effect of an action upon the environment.

Environmental impact - Used interchangeably with environmental consequence or effect.

Environmental Impact Statement (EIS) - A statement of the environmental effects of a proposed action and alternatives to it. A formal document that must follow the requirements of NEPA, the Council on Environmental Quality (CEQ) guidelines, and directives of the agency responsible for the project proposal. A Draft EIS is released to public and agencies for comment, and then a Final EIS is issued after consideration of those comments. A Record of Decision (ROD) is the decision document that informs the public of what action is to be taken.

Environmental Protection Agency (EPA) - An agency of the US Government.

Ephemeral streams - Streams having flows that occur for short periods of time in direct response to storm precipitation or snowmelt runoff. Their bottoms are always above the water table and do not contain fish or aquatic insects that have larvae with multiple-year life cycles. Ephemeral streams may have a defined channel, but may be manifested as a natural swale or depression with vegetation and organic material covering the bottom. They also may serve as a conduit for much of the sediment that enters the stream system. Large woody debris associated with ephemeral streams may also contribute significantly to the stability of

a stream system. Ephemeral streams that exhibit an ordinary high watermark, show signs of annual scour or sediment transport, are considered navigable waters of the United States.

Erosion - Detachment or movement of soil or rock fragments by water, wind, ice or gravity. Accelerated erosion is much more rapid than normal, natural or geologic erosion, primarily because of the influence of activities of man, animals or natural catastrophes.

Evapotranspiration - Loss of water from the soil both by evaporation from the soil surface and by transpiration from the leaves of the plants growing on it.

Floodplain – An area of land adjacent to a stream or river that stretches from the banks of its channel toward the base of the enclosing valley walls and experiences flooding during periods of high discharge (i.e., events larger than bankfull). It includes the floodway, which consists of the stream channel and adjacent areas that actively carry flood flows downstream, and the flood fringe, which are areas inundated by the flood, but which do not experience a strong current. The full extent of the floodplain typically considers area flooding during the 100-year flood (E.O. 11990).

Functional lift - When a stream that is functioning at the hydrology level is restored and now functions at the physiochemical level, the stream has experienced “functional lift.”

Geographic Information System (GIS) - Information processing computer technology to input, store, manipulate, analyze, and display earth-referenced spatial resource data in a map base format. GIS has two main components, the first being a data base, and the second being a display of data, both numerically, and spatially in map format.

Greenhouse gas - Any of various gaseous compounds (as carbon dioxide) that absorb infrared radiation, trap heat in the atmosphere, and contribute to the greenhouse effect.

Habitat - The place where a plant or animal naturally or normally lives or grows.

Habitat diversity - The distribution and abundance of different plant and animal communities and species within a specific area.

Habitat type - The aggregate of all areas that support or can support the same primary vegetation at climax.

Historic sediments – relatively recent undeveloped alluvial sediments deposited since colonial settlement.

Impacts - See "effects".

Indirect effects - Environmental consequences that are caused by the proposed action and are later in time or further removed in distance.

Intergovernmental Panel on Climate Change - The Intergovernmental Panel on Climate Change (IPCC) is a scientific intergovernmental body under the auspices of the United Nations, set up at the request of member governments. It was first established in 1988 by two United Nations organizations, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), and later endorsed by the United Nations General Assembly through Resolution 43/53.

Intermittent streams - Streams that flow in response to a seasonally-fluctuating water table in a well-defined channel. The channel will exhibit signs of annual scour, sediment transport, and other stream channel characteristics, absent perennial flows. Intermittent streams typically flow during times of elevated water table levels, and may be dry during significant periods of the year, depending on precipitation cycles.

IPCC – See Intergovernmental Panel on Climate Change.

Issue - A point, matter, or question of public discussion or interest to be addressed or decided through the planning.

Legacy sediments - Soils eroded through hill-slope processes, deposited on top of older, organic deposits and hydric sediments characteristic of pre-settlement riparian conditions.

National Environmental Policy Act (NEPA) - An Act to declare a National policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the Nation and to establish a Council on Environmental Quality (CEQ).

NEPA - See National Environmental Policy Act.

NFMA - See National Forest Management Act.

National Register of Historic Places (NRHP) - A listing (maintained by the U.S. National Park Service) of areas that have been designated as being of historical significance. The Register includes places of local and state significance as well as those of value to the Nation.

No Action Alternative - In environmental documents, one option for responding to the purpose and need for action. This alternative (usually Alternative 1 in most NEPA documents) is used as the "baseline" to compare the effects of other "action" alternatives. The No Action Alternative is usually defined as the present or current situation, but including ongoing activities.

Non-Native Invasive Species (NNIS) – A species that is non-native to the ecosystem and whose introduction causes rapid expansion and persistence that reduces the extent or health

of native ecosystems or is likely to cause harm to economic, environmental or human health. They can be introduced plants, animals or aquatic species.

NRHP – See National Register of Historic Places.

Objective - A concise, time-specific statement of measurable planned results that respond to pre-established goals. It forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals.

Ozone – A form of oxygen that is found in a layer high in the earth's atmosphere. Ozone is formed from dioxygen by the action of ultraviolet light and atmospheric electrical discharges, and is present in low concentrations throughout the Earth's atmosphere.

Particulate matter – Inhalable coarse particles that are larger than 2.5 micrometers and smaller than 10 micrometers in diameter.

Perennial stream - Any watercourse that generally flows most of the year in a well-defined channel and is below the water table. Droughts and other precipitation patterns may influence the actual duration of flow. It contains fish or aquatic insects that have larvae with multi-year life cycles. Water-dependent vegetation is typically associated with perennial streams.

Project - A work schedule prescribed for a Project Area to accomplish management prescriptions. An organized effort to achieve an objective identified by location, activities, outputs, effects, time period, and responsibilities for execution.

Project Area - Area of land that a proposed action affects, or planned activities would occur.

Proposed Action - In terms of NEPA, the project, activity, or decision that a Federal agency proposes to implement or undertake. This may or may not be the selected alternative in a final decision for an EA or EIS.

Ranger District - Administrative subdivisions of a National Forest, supervised by a District Ranger who reports to the Forest Supervisor.

Record of Decision (ROD) - A document separate from, but associated with an environmental impact statement that publicly and officially discloses the responsible official’s decision on the alternative assessed in the environmental impact statement chosen to implement.

Recreation - Leisure time activity including swimming, picnicking, camping, boating, hiking, hunting, and fishing.

Riparian – Land areas directly influenced by water. They usually have visible vegetative or physical characteristics showing this water influence. Streamside, lake borders, and marshes are typical riparian areas.

Riparian area - Geographically delineated areas, with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystem, floodplains and wetlands. Riparian areas are found along rivers, intermittent and perennial streams but lakes, reservoirs, estuaries, potholes, springs, bogs, wet meadows, sloughs and wetlands have functional areas often included.

Riparian corridor - An administrative zone applied to both sides of a perennial or intermittent stream or alongside a pond, lake, wetland, seep or spring as identified in the Sumter NF Plan (2004). It is a fixed width by stream type that may fall within or beyond the true riparian area (adjustments possible based upon technical review of specific circumstance).

Runoff - The total stream discharge of water from a watershed including surface and subsurface flow, but not groundwater. Usually expressed in acre-feet, or converted for specific areas to inches of water yield.

Scoping (public scoping) - Meetings, conferences, seminars, workshops, tours, written comments, responses to survey questionnaires, and similar activities designed and held to obtain comments from the public about Forest Service planning.

Scoping process - The public land management activities used to determine the range of actions, alternatives, and impacts to be considered in an Environmental Impact Statement.

Sediment - Any material transported, suspended, or deposited by water.

Sediment delivery - Eroded soil that reaches a stream course.

Sedimentation - Process of material being transported, suspended, or deposited by water.

Sensing meeting - A pre-NEPA scoping meeting designed to educate interested stakeholders on the project and solicit issues or concerns.

Sensitive species - Those species identified by the Regional Forester for which population viability is a concern. A Biological Evaluation document assesses project impacts on Sensitive species.

Stormwater runoff - Excess precipitation that is not retained by vegetation, surface depressions, or infiltration, and thereby collects on the surface and drains into a surface water body.

Stream - A watercourse having a distinct natural bed and banks; a permanent source which provides water at least periodically; and at least periodic or seasonal flows at times when other recognized streams in the same area are flowing.

Threatened species - A formal designation of the U.S. Fish& Wildlife Service. Those plant or animal species likely to become endangered species throughout all or a significant portion of their range within the near future.

Watershed - The total area above a given point on a stream that contributes water to the flow at that point.

Water vapor - Water in its gaseous state, especially in the atmosphere and at a temperature below the boiling point. Water vapor in the atmosphere serves as the raw material for cloud and rain formation.

Wetland - (pursuant to the Federal Clean Water Act) - Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances, support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas, and are found primarily within palustrine systems; but may also be within riverine, lacustrine, estuarine, and marine systems.

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INDEX

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F

G

R

S

T

U

V

W

Y

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APPENDICES

Appendix A U.S. Army Corps of Engineers Cooperating Agency Letter
Appendix B U.S. Forest Service Final Biological Assessment/ Biological Evaluation
Appendix C Comment Letters in Chronological Order
Appendix D Responses to Comments Received during the 45-day Comment Period

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APPENDIX A – U.S. ARMY CORPS OF ENGINEERS COOPERATING AGENCY LETTER

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DEPARTMENT OF THE ARMY
CHARLESTON DISTRICT, CORPS OF ENGINEERS
69-A HAGOOD AVENUE
CHARLESTON, SOUTH CAROLINA 29403-5107

REPLY TO
ATTENTION OF

Regulatory Division

AUG - 6 2014

Mr. John Richard Lint
Forest Supervisor
Francis Marion and Sumter National Forests
4931 Broad River Road
Columbia, South Carolina 29212

Dear Mr. Lint:

This letter is in response to your invitation to serve as a cooperating agency on the preparation of an Environmental Impact Statement for the *Chester County Stream and Riparian Restoration/Enhancement Project Environmental Impact Statement* (EIS). Based on your letter, it is understood that the US Forest Service will serve as the lead federal agency, pursuant to the National Environmental Policy Act (NEPA), and the Corps of Engineers will serve as a cooperating agency. Corps of Engineers regulations implementing NEPA (33 CFR Part 325) provide for this role where the Corps has jurisdiction by law and/or special expertise, to be designated a cooperating agency in the preparation of an EIS.

USACE involvement will entail aspects of the EIS related to our jurisdiction. Though no direct writing analysis may be required from our agency in the preparation of the EIS, we will be providing comments as appropriate. We expect to be actively involved in the NEPA process as well as the contents of the document in order for the FEIS to meet our regulatory needs under the NEPA, the Clean Water Act (CWA), and 33 CFR Parts 330-332. Additionally, we agree to undertake the following activities in an effort to maintain interagency cooperation:

- Determination of Basic and Overall Project Purpose for CWA on issues under our Jurisdiction;
- Participate in public and agency meetings;
  When appropriate, provide technical consultation on the scope and alternatives associated with the Project;
- Participate in joint field reviews, as appropriate;
- Provide verification of waters of the United States for the proposed site locations and alternative sites;
- Receive and review project information and technical studies, to include review and comment on the draft environmental documents.

We look forward to cooperating with USFS in the NEPA/EIS process. Though we anticipate our mutual participation will help facilitate the federal environmental permit process, it cannot be interpreted as a guarantee of permit issuance to any permit applicant.

If you have any questions concerning this matter, please contact Richard Darden at 843-329-8043 or toll free at 1-866-329-8187.

Sincerely,

for John T. Litz, PMP
Lieutenant Colonel, U.S. Army
Commander and District Engineer

APPENDIX B – U.S. FOREST SERVICE BIOLOGICAL ASSESSMENT/ BIOLOGICAL EVALUATION

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BIOLOGICAL ASSESSMENT / BIOLOGICAL EVALUATION

Chester County Stream and Riparian Restoration/Enhancement Project

US Forest Service
Enoree Ranger District
Sumter National Forest
Chester County, South Carolina

November 2014

I. INTRODUCTION

The purpose of this Biological Assessment/Biological Evaluation (BA/BE) is to determine whether the proposed action is likely to affect any proposed, endangered, threatened, or sensitive (PETS) species or their habitats.

Proposed, endangered, and threatened species are designated by the US Fish and Wildlife Service (USFWS) and are managed under the authority of the Endangered Species Act (ESA).

(Public Law 93-205, as amended) and the National Forest Management Act (Public Law 94-588). The ESA requires Federal agencies to ensure that no actions that they “authorize, fund, or carry out” are likely to jeopardize the continued existence of any proposed, endangered, or threatened species or their habitat.

Sensitive species are managed under the authority of the National Forest Management Act requiring that National Forests manage for "viable populations of all native and desirable non-native species" both across the range of the species and within the planning area. Sensitive species designation occurs on a periodic basis through the recommendation of Forest Biologists who consult with local State Heritage Programs, The Nature Conservancy, and local species experts. The Regional Forester administratively designates sensitive species.

The objectives of this BA/BE are:

- To ensure that Forest Service actions do not contribute to the loss of viability of any PETS species;
- To comply with the requirements of the ESA; and,
- To provide a process and standard to ensure PETS species receive full consideration in the decision-making process.

II. PROPOSED ACTION

The Forest Service proposes to restore and enhance the hydrologic and aquatic functions on approximately 18 miles of streams in four watersheds within the Enoree Ranger District of Sumter National Forest (Project Area). The four watersheds (Clarks Creek, Little Turkey Creek,

McCluney Branch, and an unnamed tributary to Clarks Creek) are located in the westernmost portion of Chester County, South Carolina, approximately 2 miles south of Lockhart.

Alternative 2-Proposed Action provides for restoration of the four watersheds using a variety of methods to re-establish natural channel form, floodplain function, habitat conditions, and provide functional lift. Restoration would involve moving earth and filling and shaping the channel and floodplain. Soil borrow and disposal areas needed during restoration work would be located within the four small Project watersheds and as near to the stream work to the extent possible.

To accomplish the restoration work, the following restoration design approaches would be used: P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches. Definitions for the design approaches are provided in Table 1 and a summary of the stream restoration approaches are included in Table 2.

TABLE 1: SUMMARY OF THE TERMS AND DEFINITIONS OF THE PROPOSED RESTORATION APPROACHES

Restoration Approach (based on Rosgen, 1997)	Terms and Definitions
P1-Floodplain Reconnection	• Raise the streambed and use the existing valley elevation as the floodplain. • Create a meandering stable channel on existing forest bottom with alternating riffle and pool bed forms. • Small headwater streams may have a small step-pool channel or swale. • Fill/plug sections of old stream channel and create oxbow ponds and wetlands; may include the use of groundwater dams.
P2-Floodplain Excavation	• Excavate, at the stream's existing bankfull elevation, a new floodplain that is wide enough to support a meandering channel. The stream bed elevation remains nearly the same. • Create or allow for the natural development of a meandering channel with alternating riffle and pool bed forms.
P3-Floodplain Benches	• Constraints in the stream corridor will not support a meandering channel. • Excavate relatively narrow, floodplain benches at the stream's existing bankfull elevation. • Create a relatively straight channel that dissipates energy through a step-pool bed form rather than a meandering stream.

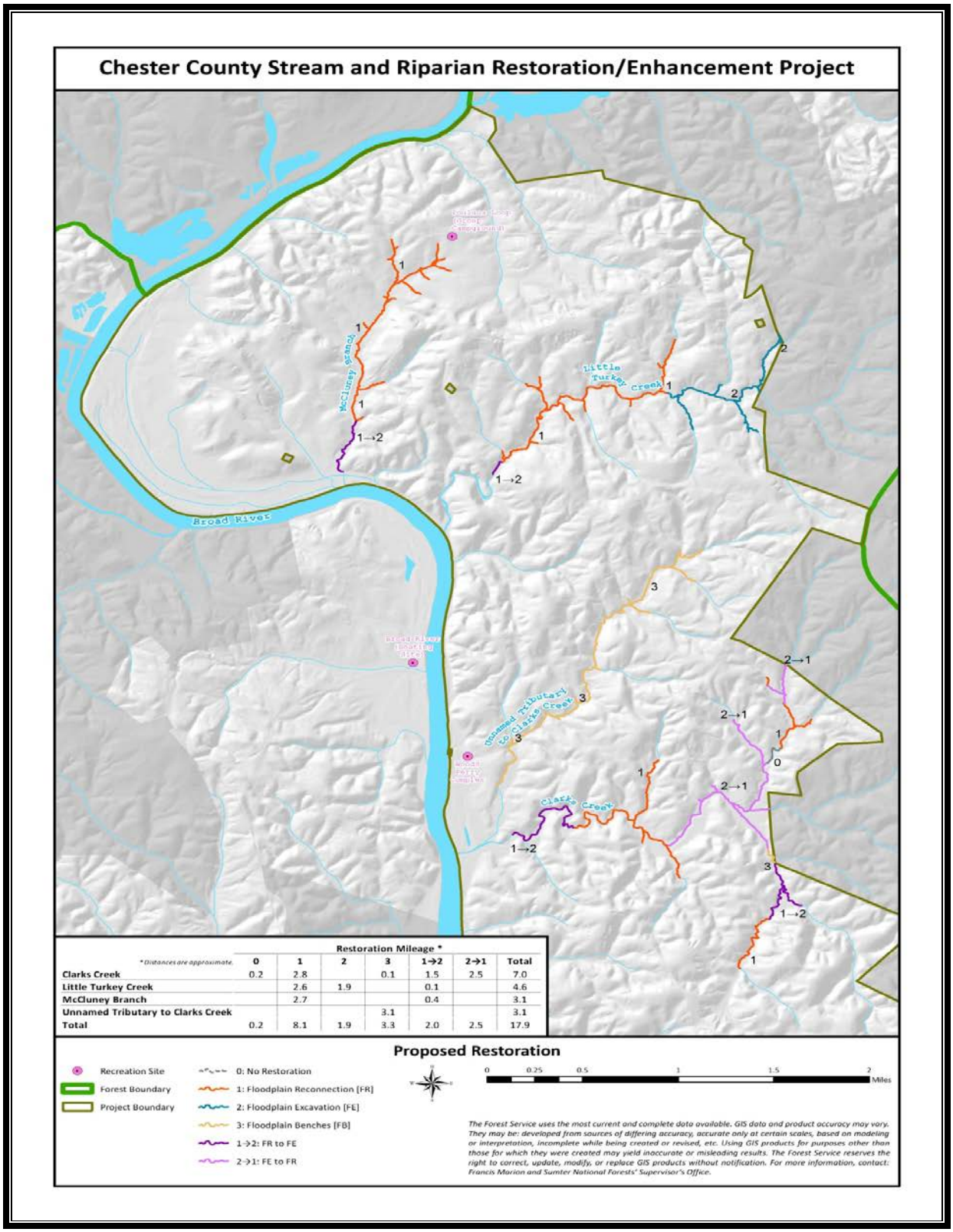
Source: Rosgen. D.L. 1997. A Geomorphological Approach to Restoration of Incised Rivers. In: Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision, S.S.Y Wang, E.J. Langendoen, & F.D. Shields (Editors). University of Mississippi. Oxford.

TABLE 2: SUMMARY OF THE PROPOSED RESTORATION APPROACHES, APPROXIMATE STREAM LENGTHS AND SOIL BORROW AND SOIL DISPOSAL QUANTITIES

			Stream Restoration Design Approach All lengths are approximate					**Connected Action-Soils All volumes are approximate**	
Project Watersheds		No Restoration	P1-FR	P2-FE	P3-FB	Transition Zone FR to FE	Transition Zone from FE to FR	Soil Borrow in CY	Soil Disposal in CY
	McCluney Branch			N/A	N/A	2,240 LF (0.4 miles)	N/A	44,100 CY	5,200 CY
	Little Turkey Creek		13,910 LF (2.6 miles)	9,830 LF (1.9 miles)	N/A	590 (0.1 miles)	N/A	93,100CY	77,100 CY
	Clarks Creek	880 LF (0.2 miles)	14,640 LF (2.8 miles)	N/A	730 LF (0.1 miles)	7680 LF (1.5 miles)	13,180 LF (2.5miles)	144,900 CY	284,600 CY
	Unnamed Tributary to Clarks Creek		N/A	NA	16,630 LF (3.3 miles)	N/A	N/A	0 CY	27,500 CY
	Total Length for each Design Approach	0.2	8.1 miles	1.9 miles	3.3 miles	2.0 miles	2.5 miles		

Key CY Cubic yards
FB Floodplain Benches
FE Floodplain Excavation
LF Linear Feet
FR Floodplain Reconnection

Selection of a restoration approach is made for each stream segment based on individual stream and floodplain conditions, and a combination of approaches is typically employed within an individual watershed to meet site conditions. An understanding of the approach can be used to generally describe the Project footprint, the amount of excavation and fill material needed to complete the work, and the ecological outcome of the proposed Project. Implementation would ultimately require more detailed designs that identify specific construction details (e.g., channel patterns, longitudinal profiles, tie-in to existing grade control features [e.g., may be slightly upstream of mapped restoration reach], cross-sections, in-stream channel structures for aquatic species habitat [e.g., large wood, rock substrate], substrate modifications, planting native vegetation, and restoration of work areas). The proposed stream restoration approaches for the various stream reaches are identified in Figure 1. The following narrative describes each watershed and the proposed stream restoration approach.



Source: USFS 2014

Note: The USDA Forest Service makes no warranty, expressed or implied, regarding the data displayed on the map, and reserves the right to correct, update, modify, or replace this information without notification.

FIGURE 1: PROPOSED STREAM RESTORATION APPROACHES

McCluney Branch

Proposed activities for restoration within McCluney Branch include P1-floodplain reconnection and P2-floodplain excavation. Depictions of P1-floodplain reconnection and P2-floodplain excavation are provided in Figure 2 through Figure 5. A hybrid restoration approach would be used in smaller drainage areas to create a wetland/intermittent stream complex with few or no defined stream channels, similar to the streams historically present in these areas. Restoration would involve some earthmoving and shaping of the floodplain using soil borrowed from areas both within and potentially outside of the watershed. In the lower portion of McCluney Branch, P2-floodplain excavation would be used to move the stream bed to the elevation of the stream near the Broad River.

Little Turkey Creek

The P2-floodplain excavation approach would be used in the upstream part of the watershed. The P1-floodplain reconnection approach would be used in the middle part of the watershed. P2-floodplain excavation would be used to reconnect the restored channel with the existing stream channel in the lower portion of the watershed. Restoration would involve some earthmoving and shaping of the floodplain using soil borrowed from areas both within and potentially outside of the watershed. Structural diversity (e.g., boulders and cobble rock) may be added to a portion of the newly created stream channel.

Clarks Creek

All three approaches (i.e., P1-floodplain reconnection, P2-floodplain excavation, and P3-floodplain benches) would be used to restore Clarks Creek. An example of floodplain benches is provided in Figure 6 and Figure 7. Restoration of the upstream portions of Clarks North Fork tributary would begin with P2-floodplain excavation, transitioning quickly to P1-floodplain reconnection below the first tributary stream; this tributary stream would have a short section of P1-floodplain reconnection in its headwaters. Downstream of this area, the P1-floodplain reconnection approach would be used before reaching a short segment where no restoration is proposed. The approach for the middle sections of Clark Creek would be to progress from P2-floodplain excavation down into P1-floodplain reconnection along the mainstem of Clarks Creek, where P2-floodplain excavation would be used to tie the restored stream into the existing stream bed. Within the Clarks South Fork tributary, P1-floodplain reconnection would proceed to P2-floodplain excavation, and then a short segment adjacent to the Project Area boundary would be restored using the P3-floodplain bench approach. The downstream area would transition from P2-floodplain excavation back to P1-floodplain reconnection, as it joins the mainstem at the confluence with Clarks North Fork. Restoration would involve extensive earthmoving and shaping of the floodplain, including both the use of borrowed soil and disposal of excess soil to areas outside of the floodplain but within upland areas of the watershed.

Unnamed Tributary to Clarks Creek

The unnamed tributary to Clarks Creek would be restored using the P3-floodplain benches approach and P2-floodplain excavation in particular sections. Restoration activities proposed on this stream would be targeted in key problem areas to augment natural changes the stream channel undergoes as it moves toward greater stability. Restoration would involve moderate to extensive earthmoving and shaping of the floodplain in key areas, including both the use

of borrowed soil and disposal of excess soil to areas outside of the floodplain. Soil borrow and disposal areas would be located within the watershed to the most reasonable extent possible.

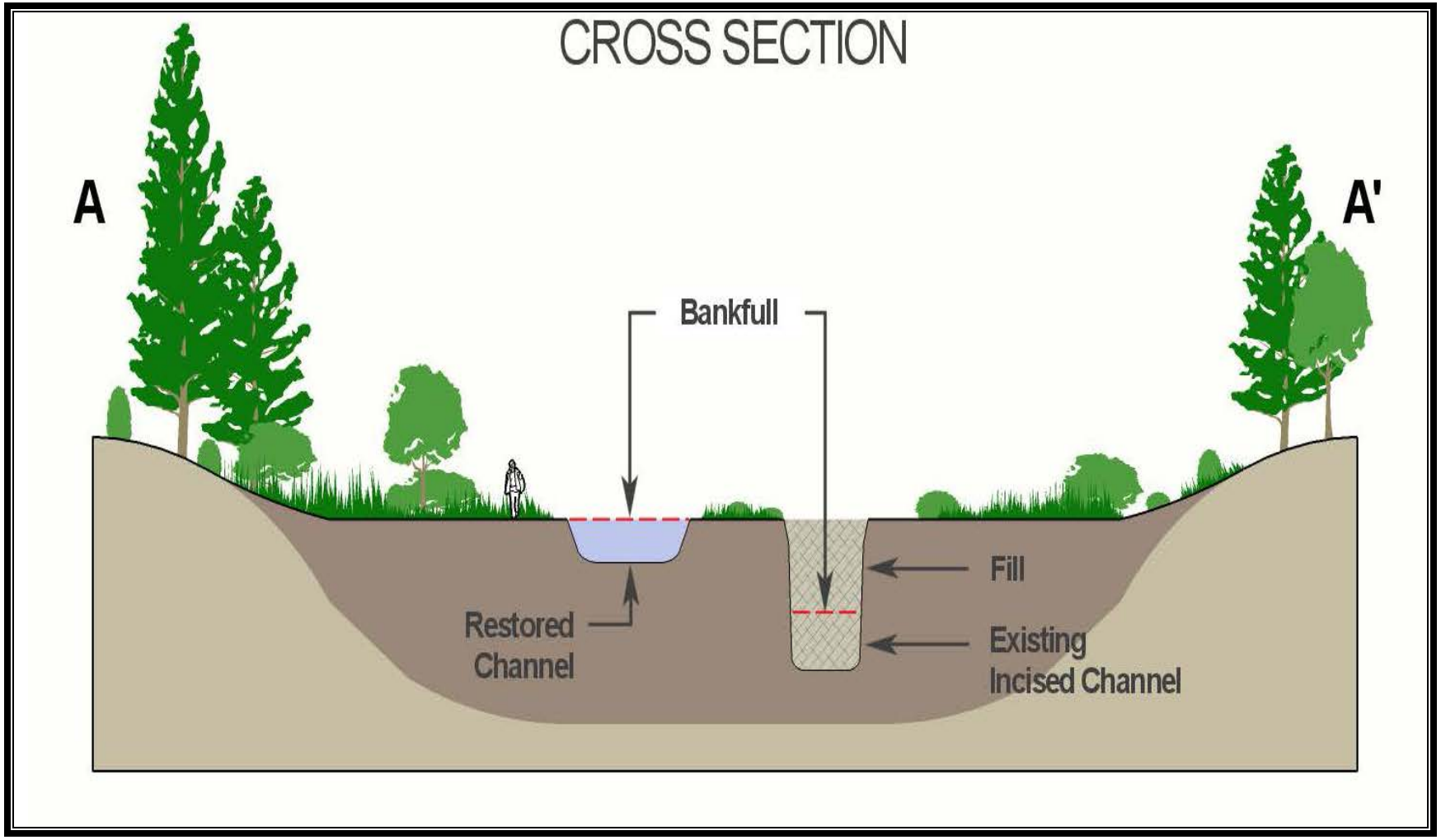


FIGURE 2: P1-FLOODPLAIN RECONNECTION APPROACH-CROSS SECTION VIEW

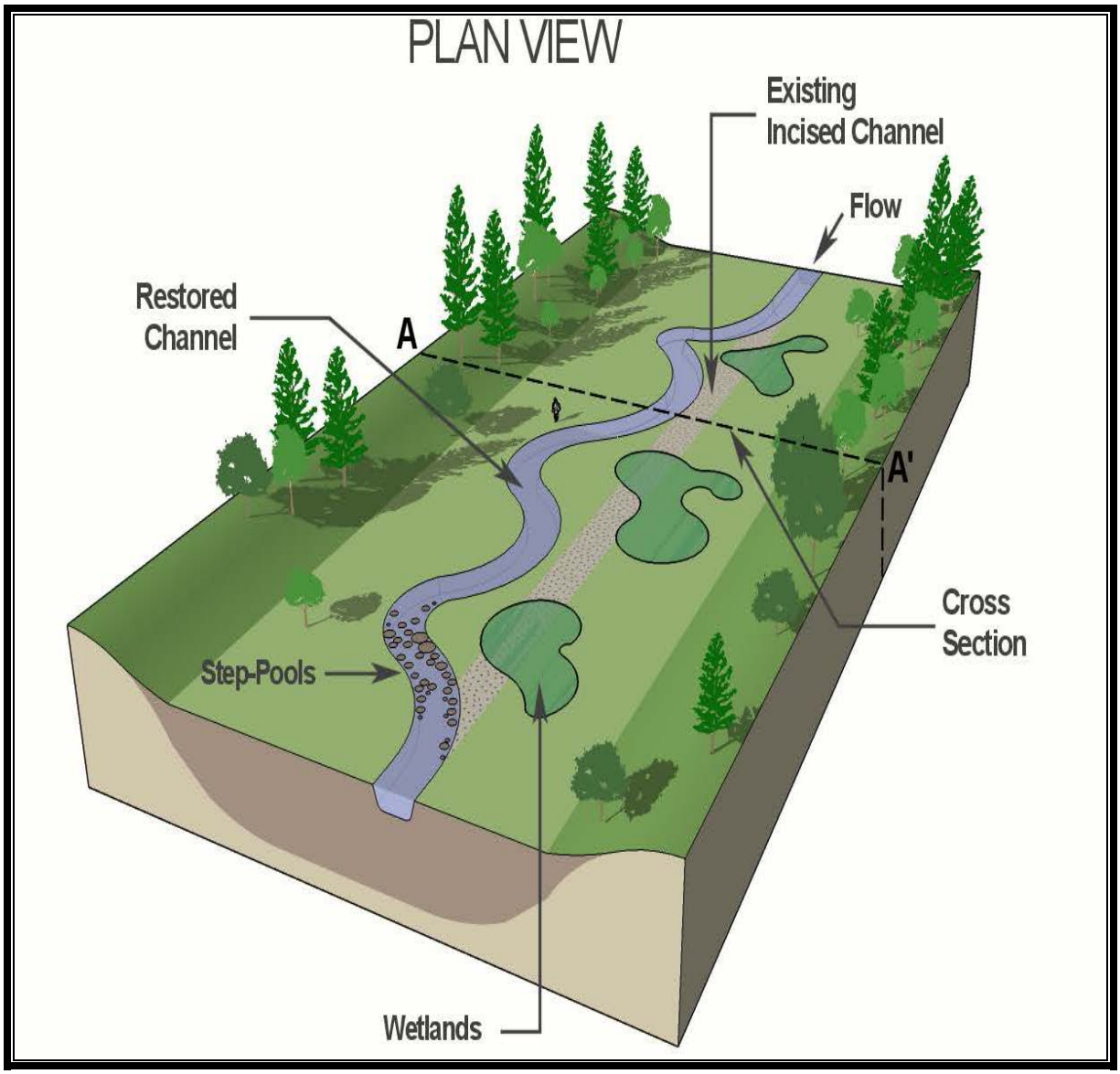


FIGURE 3: P1-FLOODPLAIN RECONNECTION APPROACH-PLAN VIEW

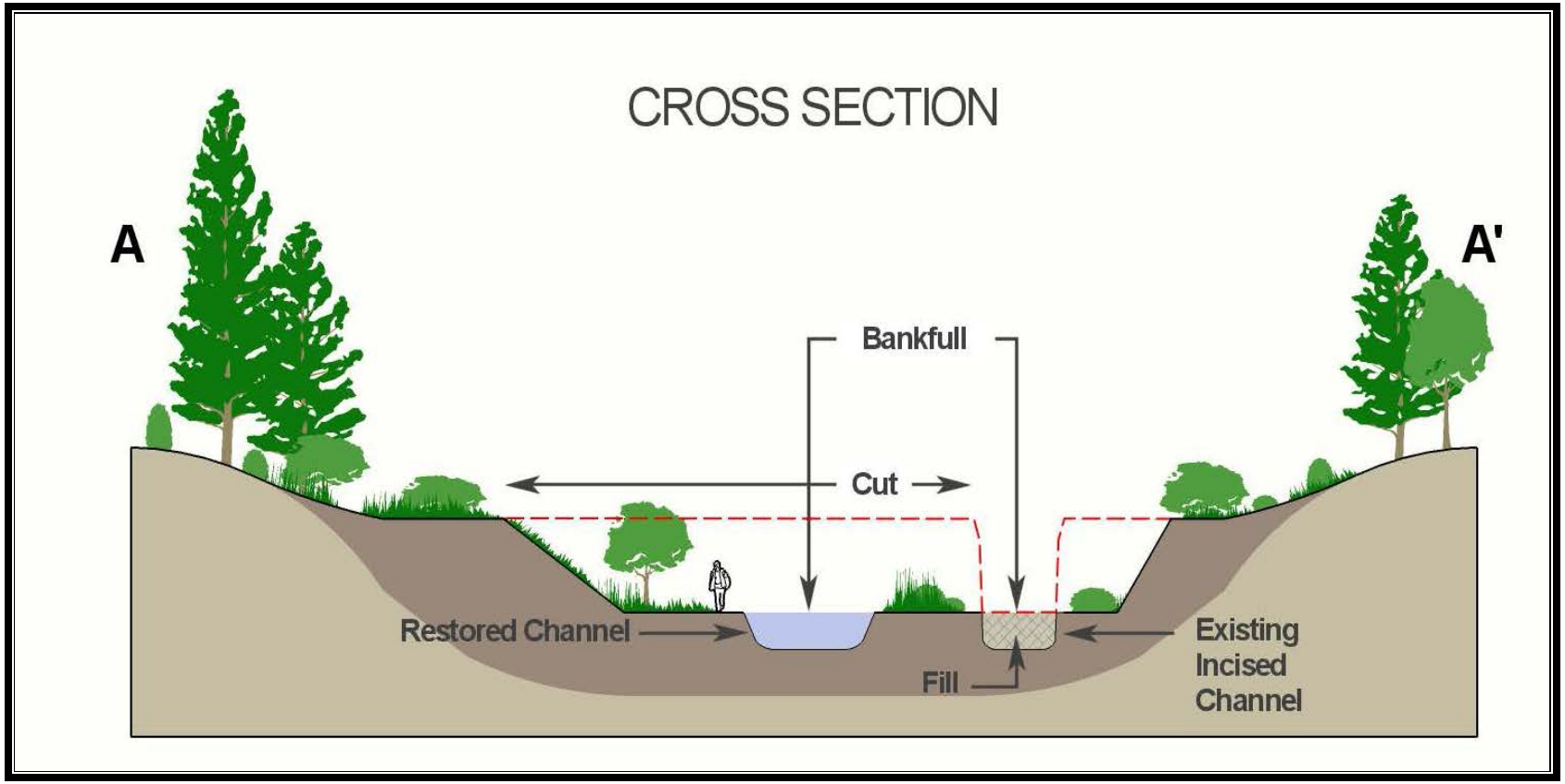


FIGURE 4: P2-FLOODPLAIN EXCAVATION APPROACH-CROSS SECTION VIEW

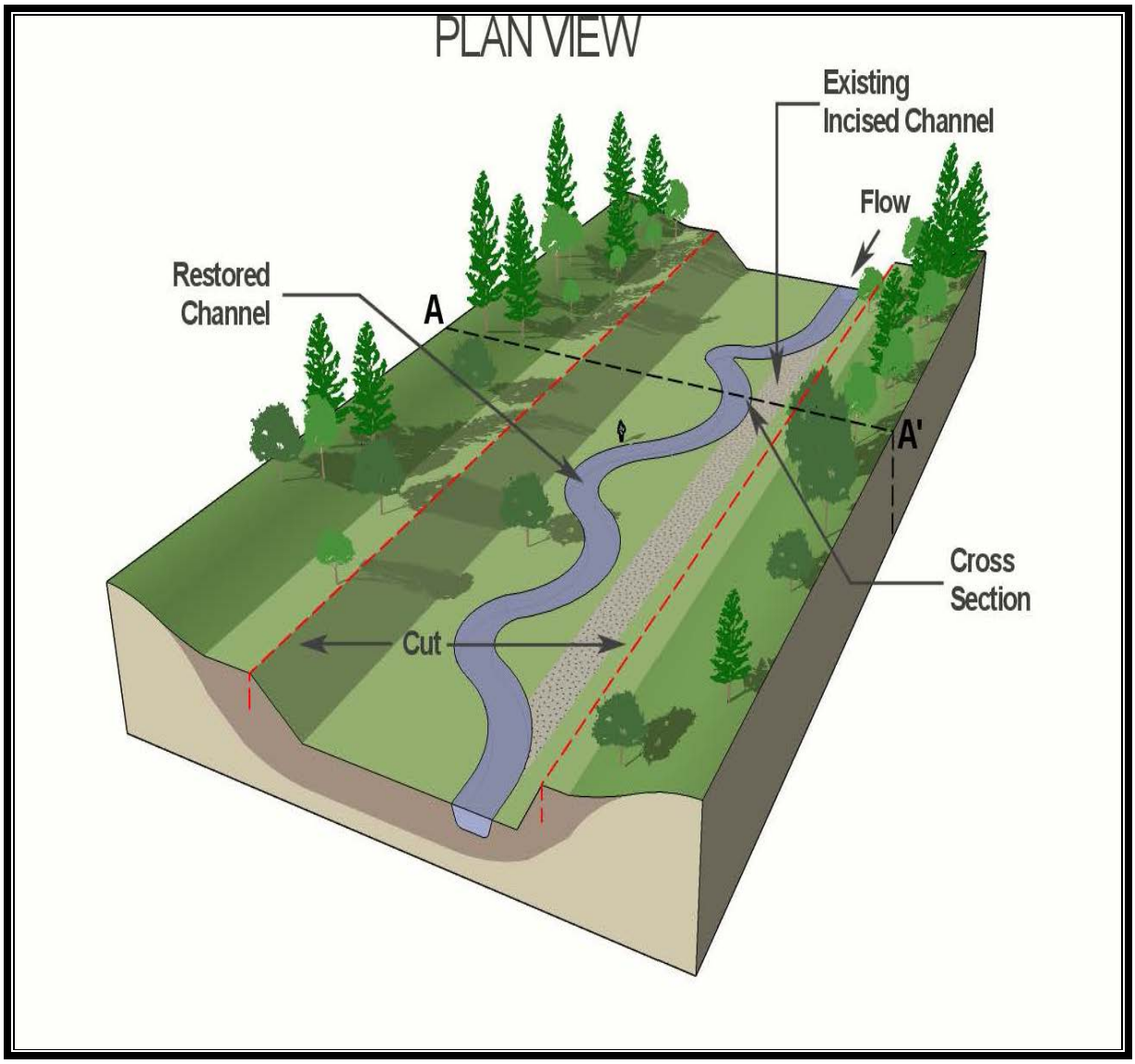


FIGURE 5: P2-FLOODPLAIN EXCAVATION APPROACH-PLAN VIEW

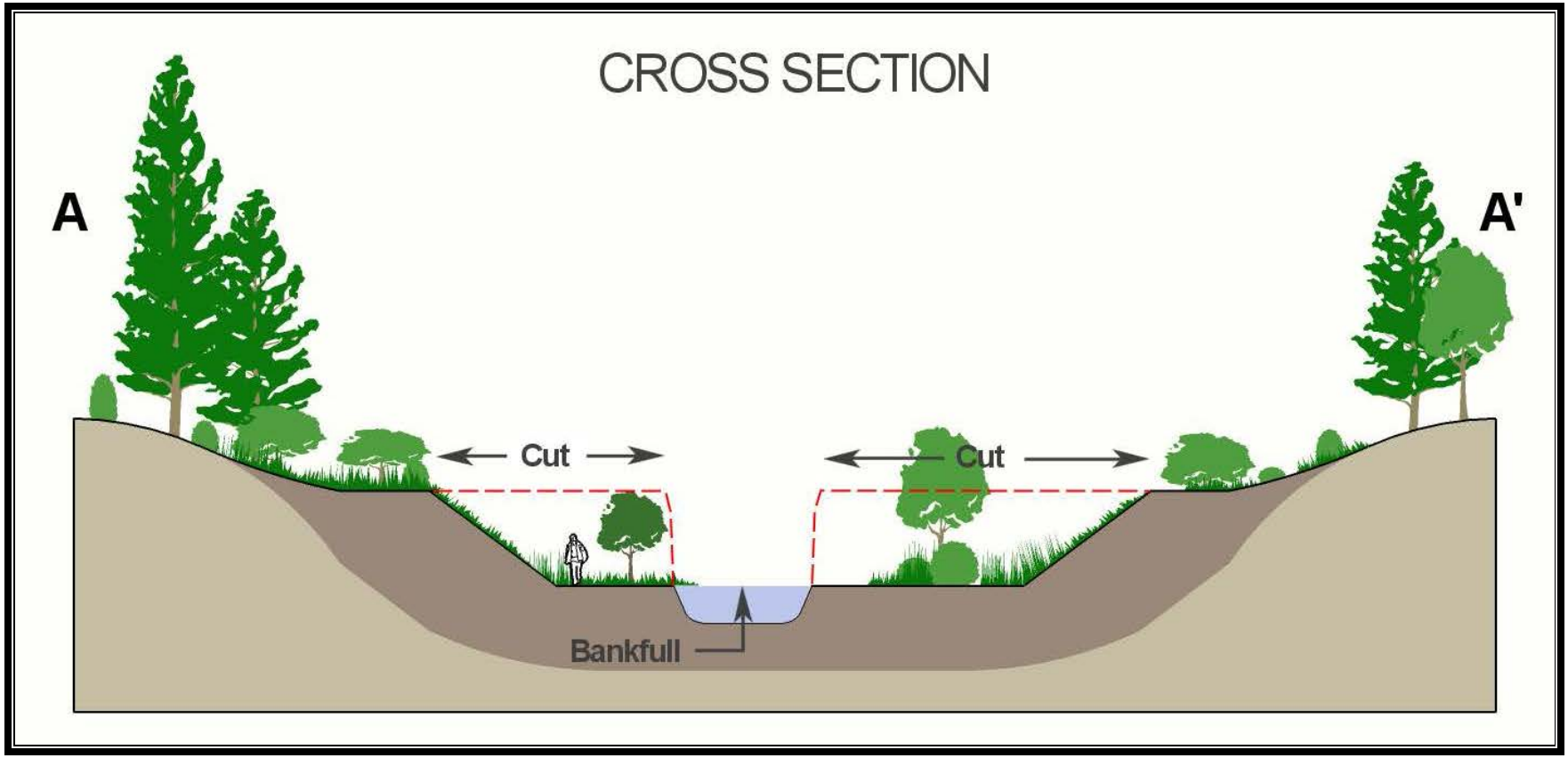


FIGURE 6: P3-FLOODPLAIN BENCH APPROACH-CROSS SECTION VIEW

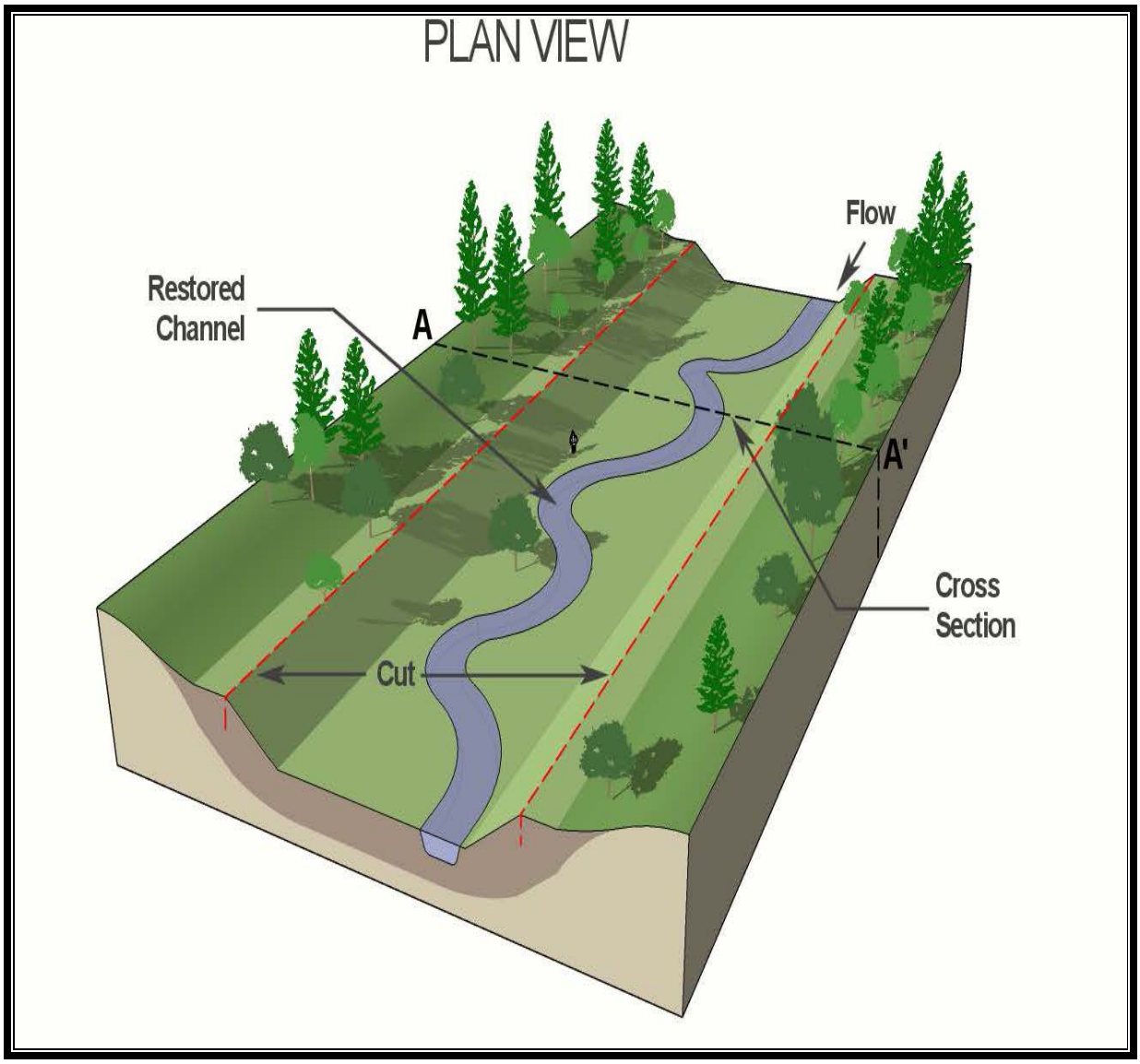


FIGURE 7: P3-FLOODPLAIN BENCH APPROACH-PLAN VIEW

Forest Plan Amendment

Alternative 2-Proposed Action includes a non-significant Forest Plan amendment. The amendment would change current Forest Plan management direction to allow for implementation (construction, reconstruction and maintenance) of the Project in and along Project streams only.

Proposed Forest Plan changes would:

1. Allow heavy equipment within Project stream channels during implementation and maintenance activities.
2. Allow removal of trees and other vegetation on Project stream banks during implementation and maintenance activities.
3. Allow removal of hardwood inclusions (1/2 acre in size or larger) in pine stands dominated by hard and soft mast species where needed during implementation activities.
4. Allow removal of trees in areas with old growth characteristics where necessary during implementation of the stream restoration Project.
5. Allow removal of healthy shortleaf pine in areas where necessary during implementation of the stream restoration Project.
6. Allow stream restoration Project work to take place on plastic soils with approval of the Forest Service soil scientist on a case-by-case basis.
7. In the short term, change the Scenic Integrity Objective (SIO) for stream restoration work to moderate in management prescriptions 6.C, 7.D, 7.E.1, 7.E.2, 9.A.3, 9F, and 11 in the Project Area to allow the restoration work to be completed.
8. Allow temporary removal of large woody material during restoration and maintenance work.
9. Allow minimal impacts to rare communities during Project stream restoration and maintenance work.

Connected Actions

The following activities would be conducted in connection with Alternative 2-Proposed Action.

Road Reconstruction and Maintenance

Approximately 23 miles of existing Forest Service roads would require maintenance, reconstruction, or both in order to allow access by the heavy equipment needed for restoration. Reconstruction and maintenance would also be required on up to 5.6 miles of state roads that may be needed during Project activities. Reconstruction work would include graveling road surfaces; replacing culverts (including designing culverts for passage of aquatic organisms); repaving/chip-sealing, cleaning ditches; removing brush and trees along rights-of-way; installing, repairing, or replacing gates; and correcting road safety hazards. Some bridges may need to be replaced to accommodate the new elevation of restored streams. Road maintenance would consist of replacing gravel in selected spots, road grading, repaving/chip-sealing, cleaning culverts, and light brushing and mowing.

Temporary Roads
Approximately 13 miles of temporary roads would be constructed during Project implementation. Upon completion of restoration activities, temporary roads would be closed and obliterated. Adequate measures would be implemented to control erosion and stormwater. Road surfaces would be replanted with native and desirable non-native vegetation.

Soil Borrow and Soil Disposal Areas
Implementing Alternative 2-Proposed Action would generate the need for soil to fill in and shape the new channels and adjacent areas. Likewise, deposited sediment would have to be removed from some locations, generating soil that would need to be deposited elsewhere. Approximately 663 acres of National Forest system lands within the Project Area have been identified as potential soil deposit or borrow areas. Not all of these areas would be needed during Project activities. The intent in selecting these areas is to ensure the least impact on natural resources while providing flexibility in design and efficient transport to stream restoration areas (as needed). Soil testing may be needed to identify areas that have the appropriate characteristics to be used as fill material in streams. Sites would be cleared of trees and stumps. Areas would be replanted with trees. Planted trees would include those appropriate for the site and include, but not be limited to, shortleaf pine, loblolly pine and hardwoods. Excess soil would be spread over areas to a depth of 12 to 18 inches. Soil borrow areas would likely would be filled in and returned to their original contour. Old road beds in these areas may be filled in and returned to a natural condition. All disturbed areas would be stabilized following standards in the Forest Plan, which could include seeding with native and desired non-native plants to control erosion, dips, leadouts, reverse grades or water-barring to control concentrated flow to limit erosion and sedimentation, and if appropriate, other practices such as installing silt fencing and creating sediment ponds. The Forest Service estimated that between 70-100 acres would be used for soil borrow and soil disposal.

Merchantable Timber
Implementing Alternative 2-Proposed Action would require removing trees within the stream restoration areas and from the soil borrow and disposal areas. Merchantable timber probably would be sold (estimates of volumes, costs, and value of timber are described in Section 3.14 of the EIS). Some of the woody material would be used to stabilize and restore streams. Trees would be cut down, skidded to landings, and transported off site or used in the restoration work. All landings and skid trails would be closed, water-barred, and seeded after construction. Any staging/mobilization and equipment storage areas needed would be located in previously disturbed areas, as much as possible.

III. CONSULTATION HISTORY

This BA/BE tiers to the Biological Assessment for the 2004 *Revised Land and Resource Management Plan, Sumter National Forest* (Forest Plan). The USFWS was consulted informally on the Forest Plan BA and concurred with a determination of “not likely to adversely affect.”

IV. SPECIES CONSIDERED AND EVALUATED

The complete list of PETS species for the Sumter National Forest is attached in Appendix A. All species on this list were considered for this BA/BE. Using a step-down process species and potential habitat in the project area were identified by:

1) Evaluating the location and nature of the proposed project;
2) Considering the species' range, life history, and available habitat information;
3) Reviewing records of known PETS species occurrences, which includes data from the South Carolina Heritage Trust Geographic Database of Rare, Threatened, and Endangered Species; and,
4) Reviewing the USFWS's South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species – Chester County (2013).

The USFWS's South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species (2013) identifies red-cockaded woodpecker (*Picoides borealis*), Carolina heelsplitter (*Lasmigona decorata*) and Georgia aster (*Symphyotrichum georgianum*) as potentially occurring in Chester County. Red-cockaded woodpecker is not included on the Sumter National Forest PETS list based on analysis in the Forest Plan. Carolina heelsplitter is eliminated from analysis in this BA/BE because it is not known to occur within the project area. Bald eagle (*Haliaeetus leucocephalus*) and Georgia aster occur within the project area and will be addressed in this BA/BE. Potential habitat exists for indigo bush (*Amorpha schwerini*), lanceleaf trillium (*Trillium lancifolium*), nodding trillium (*T. rugelii*), piedmont aster (*Eurybia mirabilis*), sweet pinesap (*Monotropsis odorata*), and wood stork (*Mycteria americana*). These species will also be addressed in this BA/BE. All other species on the Sumter National Forest PETS list are eliminated from this analysis because they are not known to occur within or adjacent to the project area and they lack suitable habitat.

V. EVALUATED SPECIES SURVEY INFORMATION

The procedure used to decide when to inventory for PETS species is consistent with Forest Service Manual (FSM) 2672.43. Surveys for mollusks (including Carolina heelsplitter) and fish (including Carolina darter, *Etheostoma collis*, and robust redhorse, *Moxostoma robustrum*) were included in baseline surveys conducted by The Catena Group during April 2012 through August 2013 (Atkins North America, Inc. 2014a; The Catena Group 2013). Freshwater mussels were also surveyed within the Broad River Basin in 2008 (Alderman 2008). Carolina heelsplitter, Carolina darter, and robust redhorse are not known to occur within the project area.

Avian PETS species were surveyed during April 16-27, 2012; September 28-October 2, 2012; May 7-15, 2013; and September 3-11, 2013 (Atkins North America, Inc. 2014b). Additionally, point counts (Hamel et al. 1996) have been used by the Forest Service to monitor avian population trends and habitat occurrences within the project area since 1994. A systematic survey for bald eagle nests was conducted within a one-mile buffer of the Broad River. No nests were detected during this survey; however, in September 2012 a bald eagle was observed near the bridge over McCluney Branch. An active bald eagle nest is

known to occur near McCluney Branch Road (FS Road 301H), which is immediately adjacent to the project area. Although wood storks were not observed during surveys or other field activities, potential habitat exists, especially along larger stream reaches such as Clarks Creek. Bachman's sparrow (*Aimophila aestivalis*) and migrant loggerhead shrike (*Lanius ludovicia migrans*) are not known to occur within the project area and lack suitable habitat.

Botanical PETS species were also surveyed during April 16-27, 2012; September 28-October 2, 2012; May 7-15, 2013; and September 3-11, 2013 (Atkins North America, Inc. 2014b). Four new occurrences of Georgia aster were located during surveys. No other botanical PETS species were located during surveys, but suitable habitat exists for indigo bush, lanceleaf trillium, nodding trillium, piedmont aster, and sweet pinesap.

VI. ENVIRONMENTAL BASELINE FOR THE SPECIES EVALUATED

See the Forest Plan Final BA and BE and the 2012 Forest Plan Monitoring Report (US Forest Service 2013) for information on the status and environmental baseline for PETS species on the Sumter National Forest.

Bald eagles nest in tall, usually living trees near an open body of water. This species usually forages near estuaries, lakes, ponds, rivers, open marshes, and shorelines. Bald eagles will soar over a body of water and swoop to the surface for fish. They also scavenge for dead fish and other carrion along shores and occasionally consume small birds and mammals. Although nationwide recovery efforts led to the removal of bald eagles from the Threatened and Endangered Species List on August 9, 2007 (Federal Register 2007), this species is still protected under the Bald and Golden Eagle Protection Act (16 USC 668-668c) and the Migratory Bird Treaty Act (16 USC 703-712).

There are four known bald eagle nests on the Enoree Ranger District. They are located in compartment 6 (active in 2014), compartment 18 (inactive in 2014), compartment 108 (status unknown in 2014), and compartment 116 (status unknown in 2014). The compartment 6 nest, located near McCluney Branch Road (FS Road 301H), is immediately adjacent to the project area (see Map 1 in Appendix B). The compartment 18 nest is approximately 2 ½ miles from the project area. The nests in compartments 108 and 116 are located greater than 15 miles away. Additionally, the Broad River is used as foraging habitat and much of the project area along the Broad River may provide potential nesting or roosting habitat.

Georgia aster is a relict species of the savanna/woodland plant community that existed in the southeast prior to widespread fire suppression and extirpation of large native grazing animals. The majority of the remaining populations survive adjacent to roads, along woodland borders, in dry, rocky woods, and within utility rights-of-way and other openings where current land management practices mimic natural disturbance regimes. Many existing populations across its range are threatened by woody plant succession resulting from fire suppression, development, highway expansion/improvement, and herbicide application.

Based on 2013 monitoring data, nearly 6,000 plants from twelve populations are known to occur on the Sumter National Forest (US Forest Service 2012). On the Enoree Ranger District, there are seven geographically distinct populations with a total of approximately 3,200 plants. Georgia aster occurs near and within the project area (see Map 2 in Appendix B). The Wade Road (FS Road 301A) occurrence is located within a proposed soil borrow deposition area; the Bucks Grave Road (FS Road 305) and Hines Road (FS Road 305E) occurrences are located immediately adjacent to proposed temporary roads and designated soil borrow/deposition areas; the Wild Turkey Road (FS Road 301C) occurrence is located within close proximity to the project area; and the Neal Shoals Road (FS Road 304) and Camp Leeds Road (FS Road 305L) occurrences are located near but not immediately adjacent to the project area. The Clarks Creek Road (End of FS Road 305K) occurrence is located within a proposed stream restoration corridor; however, Georgia aster were not detected at this site during surveys in 2012 (Atkins North America, Inc. 2014b), or in 2010, 2007, 2004, or 2003 (US Forest Service 2012). The occurrence record at Clarks Creek Road is assumed to no longer contain Georgia aster.

Indigo bush is endemic to the southeastern piedmont. It occurs in rather xeric and rocky river bluffs and woodlands. Indigo bush is known to occur at one location on the Enoree Ranger District (compartment 35), approximately 15 miles from the project area. Although this species was not detected during project botanical surveys, small amounts of suitable habitat for indigo bush exist within the project area at access locations.

Lanceleaf trillium habitat is described by Weakley (2007) as “rich forests over marble, limestone, and other calcareous substrates, floodplain forests.” This species occurs on the Sumter National Forest (Long Cane Ranger District), but has never been recorded on the Enoree Ranger District. However, potential habitat does exist along the stream reaches within the project area, particularly Little Turkey Creek and McCluney Branch.

Nodding trillium occurs in deciduous forest hillsides and coves, mostly in alluvial soils along stream banks and flats. This species is known to occur at one site on the Enoree Ranger District (compartment 77), approximately 20 miles from the project area. Although not known to occur within the project area, potential habitat does exist within stream restoration areas.

Piedmont aster is found in nutrient-rich bottomlands and moist slopes in the lower Piedmont of North Carolina and South Carolina. It inhabits deciduous or mixed deciduous woods, is found on slopes or alluvial plains, and usually occurs on basic or circumneutral soils. Piedmont aster is known to occur at one location on the Sumter National Forest (Long Cane Ranger District), but has not been located on the Enoree Ranger District. Although this species is not known to occur within the project area, potential habitat does exist.

Sweet pinesap is a cryptic species that occurs in dry to mesic upland woods under oaks and/or pines (especially Virginia pine, *Pinus virginiana*, and shortleaf pine, *P. echinata*), especially slopes or bluffs with abundant heaths. There are two records of sweet pinesap on the Enoree Ranger District (one in compartment 35 and one on private property near the town of Whitmire). Both occurrences are approximately 15 miles away from the project

area. Because this species is inconspicuous and difficult to detect during surveys, it possible that it is more common across the landscape than occurrence records suggest. Sweet pinesap is not known to occur within the project area, but potential habitat does exist.

Wood storks were listed as endangered on February 28, 1984 (Federal Register 1984). In 2010 USFWS initiated a review of the species' status to determine if reclassification from endangered to threatened is warranted (Federal Register 2010). In June 2014, USFWS announced that wood storks would be down-listed from endangered to threatened (Federal Register 2014). Wood storks currently breed throughout Florida, Georgia, South Carolina, and North Carolina. The closest nesting colony is in Georgia just south of the Savannah River Site, at least 100 miles to the southeast. Post-breeding wood storks occasionally disperse as far north as North Carolina and as far west as Mississippi. Portions of the Enoree Ranger District are infrequently used in late summer and early fall by post-breeding wood storks. This species forages in small wetlands, including beaver ponds and small streams. Use of most feeding areas is short-term and the use of any individual area varies from year-to-year depending on water levels and the availability of forage fish. The use of these sites as foraging areas is dependent on the availability of appropriate water levels during late summer, which to a great degree is dictated by weather conditions. Wood storks have not been observed within the project area, but potential habitat does exist.

VII. EFFECTS OF PROPOSED MANAGEMENT ACTION ON EACH SPECIES EVALUATED

This effects analysis takes into account not only the knowledge of species distribution from previous field surveys, but also the adequacy of those surveys. The best available science (including species' habitat requirements, reasons for species' decline, limiting factors, project area habitat conditions, and the biological effects of the intensity of the proposed action) is also considered in the effects analysis. The effects of a proposed action on a species can be direct, indirect, or cumulative.

Direct Effects

Direct effects are effects to the species known to occur in the proposed project area. They occur at the same time and place as the project activity.

Bald eagle. Stream restoration activities (floodplain reconnection, floodplain excavation, and floodplain benches) and related activities addressed in the proposed Forest Plan amendment are not likely to directly affect bald eagles using the McCluney Branch Road nest since it is located outside of all stream restoration corridors. However, connected actions (road reconstruction and maintenance, the construction of temporary roads, the removal of timber within soil borrow/deposition areas, and soil borrow and deposition activities) and related activities addressed in the proposed Forest Plan amendment would likely disturb nesting bald eagles, potentially affecting foraging behavior and reproductive success. To avoid adverse

direct effects, Forest Plan Standard FW-28[4] (stated as design criterion #1 on page 21) would be followed. If other nests are found before or during project implementation, then Forest Plan Standard FW-28 (design criterion #1) would apply.

Georgia aster. Stream restoration activities (floodplain reconnection, floodplain excavation, and floodplain benches) and related activities addressed in the proposed Forest Plan amendment are not likely to affect Georgia aster because no plants occur within any of the stream restoration corridors. However, individual plants – and in one case the whole occurrence (Wade Road) – could be disturbed or destroyed by connected actions (road reconstruction and maintenance, temporary road construction, timber removal, and soil borrow/deposition activities) and related activities addressed in the proposed Forest Plan amendment. In order to avoid direct effects to Georgia aster, design criteria #2-6 would be followed (see page 21).

Indigo bush, lanceleaf trillium, nodding trillium, piedmont aster, and sweet pinesap are not known to occur within or adjacent to the project area. There would be no direct effects to these species during the implementation of the proposed action.

Wood stork. Potential wood stork habitat exists within the proposed project area. It is possible that if wood storks were present during project implementation they would be disturbed and forced to leave the area. Because wood storks are highly mobile avian species, they would simply disperse to undisturbed areas. Wood storks are likely return once the disturbance is over and their wetland habitats are restored. Direct effects are not likely to occur to this species.

Indirect Effects

Indirect effects are effects to the species' habitat in or near the project area and they could occur during or after project implementation.

Bald eagle. The existing bald eagle nest on McCluney Branch Road would not be affected by project activities. Forest Plan Standard FW-28 and design criterion #1 would protect the nest and surrounding canopy from disturbance or modification. However, tree removal within the stream restoration corridors and within the soil borrow/deposition areas would affect potential nest and roost sites. However, considering the amount of available habitat within the surrounding areas, any loss of potential nest or roost sites is insignificant and would not have an adverse indirect effect on bald eagles.

[4] Forest Plan Standard FW-28 (p. 2-9): "Protection zones are delineated and maintained around all bald eagle nests and communal roost sites, until they are determined to be no longer suitable through coordination with the U.S. Fish and Wildlife Service. The protection zone extends a minimum of 1,500 feet from the nest or roost. Activities that modify the forest canopy within this zone are prohibited. All management activities not associated with bald eagle management and monitoring are prohibited within this zone during periods of use (nesting season is October 1 to June 15; roost use periods are determined through site-specific monitoring). Where controlled by the Forest Service, public access routes into or through this zone are closed during the season of use, unless they are major arterial roads."

Georgia aster habitat would not likely be affected within stream restoration corridors. These areas include predominantly aquatic habitats, streambanks, and floodplains, which are not suitable habitat for Georgia aster. Georgia aster habitat could be affected by activities that take place along roadsides or utility rights-of-way, in open woods, or other suitable habitats. In order to avoid adverse effects to habitats that are currently occupied by Georgia aster, design criteria #2-6 would be followed.

Indigo bush, lanceleaf trillium, nodding trillium, piedmont aster, and sweet pinesap. Habitat for these species would be adversely affected within stream restoration areas, soil borrow/deposition areas, by the placement of temporary roads, and with the implementation of related activities addressed in the proposed Forest Plan amendment. Existing vegetation would be removed and soils would be disturbed significantly at these sites. It would take several years after project implementation for habitats within project area to become suitable for these species again.

Wood stork. Stream restoration activities (floodplain reconnection, floodplain excavation, and floodplain benches) and related activities addressed in the proposed Forest Plan amendment would result in the immediate but short-term loss of wetland habitats. After streams are restored, the quantity and quality of wood stork habitat would increase, benefiting the species. Connected actions (road reconstruction and maintenance, temporary road construction, timber removal, and soil borrow/deposition activities) and related activities addressed in the proposed Forest Plan amendment are not expected to affect wood stork habitat, because they would occur in places where there are no existing wetlands.

Cumulative Effects

Cumulative effects are those resulting from incremental impacts of the proposed action added to other past, present, and future actions. Cumulative effects can result from individually minor but collectively significant actions that take place over a period of time.

Other management activities that have taken place on the Enoree Ranger District include prescribed burning, timber sales, precommercial thinning and release of timber, southern pine beetle control, recreation trail reconstruction and maintenance, seeding of roads, skid trails, firelines, and log decks, road maintenance (grading, brushing, and mowing), and wildlife opening management. Most of these activities are expected to continue in the near future at approximately the same levels.

Private lands within or adjacent to the proposed project areas are made up of timberland, home sites, pastures, and farmland. Intensive timber management activities on private lands, including thinning, regeneration cuts, and road building, have occurred heavily over the past 10 years within some of these areas.

The cumulative effects of the proposed project in combination with other past, present, and future actions are not anticipated to result in any measurable loss of the evaluated species or their habitats.

VIII. DETERMINATION OF EFFECT AND RATIONALE

Proposed, Endangered, and Threatened Species

Wood stork – NOT LIKELY TO ADVERSELY AFFECT (ESA Section 7 consultation with USFWS is required)

Rationale: While project activities would have no direct effect on wood storks, there may be short-term loss of wetland habitats; however, once streams are restored, wood stork habitat is expected to improve.

Sensitive Species

Bald eagle – NO IMPACTS

Rationale: With the implementation of Forest Plan Standard FW-28 and design criterion #1, there would be no effects to bald eagles.

Georgia aster – NO IMPACTS

Rationale: With the implementation of design criteria #2-6, there would be no effects to Georgia aster.

Indigo bush, lanceleaf trillium, nodding trillium, piedmont aster, and sweet pinesap – MAY IMPACT INDIVIDUALS BUT NOT LIKLEY TO CAUSE A TREND TO FEDERAL LISTING OR A LOSS OF VIABILITY

Rationale: There would be no direct effects to these species because they are not known to occur within the project area. Potential habitat for these species would be adversely affected by the proposed action.

IX. DESIGN CRITERIA

Per FW-28, the following measures shall be followed:

1. Protection zones are delineated and maintained around all bald eagle nests and communal roost sites, until they are determined to be no longer suitable through coordination with the U.S. Fish and Wildlife Service. The protection zone extends a minimum of 1,500 feet from the nest or roost. Activities that modify the forest canopy within this zone are prohibited.

   All management activities not associated with bald eagle management and monitoring are prohibited within this zone during periods of use (nesting season is October 1 to June 15; roost use periods are determined through site-specific monitoring). Where controlled by the Forest Service, public access routes into or through this zone are closed during the season of use, unless they are major arterial roads.

2. Coordinate all ground-disturbing activities (including road reconstruction and maintenance, temporary road construction, timber harvesting operations, and soil borrow/deposition activities) with Forest Service biological staff within and near the following Georgia aster sites: Wade Road (FS Road 301A), Wild Turkey Road (FS Road 301C), Bucks Grave Road (FS Road 305), and Hines Road (FS Road 305E), and other sites that may be identified in the Project Area in the future.
3. Avoid damage to Georgia aster during road reconstruction and maintenance activities.
4. Temporary roads are not permitted within Georgia aster sites.
5. Timber harvesting is permitted within Georgia aster sites, but the following measures shall be followed:
    a. Avoid the use of logging equipment and other heavy machinery within Georgia aster sites (hand tools may be used to fell trees within Georgia aster sites).
    b. Attempt to fell trees away from Georgia aster sites.
    c. Skid trails and log decks are prohibited within Georgia aster sites. Avoid skidding trees through Georgia aster sites; however, trees may be skidded out of Georgia aster sites as long as damage does not occur to Georgia aster).
6. Soil borrowing and deposition is prohibited within Georgia aster sites. This activity is permitted adjacent to Georgia aster sites as long as there are no direct or indirect effects to Georgia aster.

X. SIGNATURE

This Biological Assessment/Biological Evaluation was prepared by:

/s/ Jeffrey M. Magniez *11/4/2014*

Jeffrey M. Magniez Date
Zone Wildlife Biologist
Sumter National Forest

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APPENDIX A – Sumter National Forest PETS List

Proposed, Endangered, Threatened, and Sensitive (PETS) Species of the Sumter National Forest (2014). Obs = Observed during field surveys or known to occur based on previous records; Hab = Suitable habitat exists within the project area; "+" = meets criterion, "--" = does not meet criterion. P = piedmont (Enoree and Long Cane Ranger Districts), M = mountains (Andrew Pickens Ranger District).

Species	Status	Habitat Description / Reason for Including In or Excluding From Analysis	Obs	Hab	Range
CAROLINA HEELSPLITTER *Lasmigona decorata*	Federally Endangered	Known historically from Catawba, Pee Dee, and Saluda drainages in South Carolina; occurs in Mountain, Beaverdam, Cuffytown, Sleepy, and Turkey Creeks **Not known to occur within project area**	--	--	P
NORTHERN LONG-EARED BAT *Myotis septentrionalis*	Proposed Federally Endangered	Winters in caves and cave-like structures (e.g., mines, railroad tunnels); summer roosts include cavities, underneath bark, crevices, or hollows of both live and dead trees **Outside of known range**	--	--	M
PERSISTENT TRILLIUM *Trillium persistens*	Federally Endangered	Known from one site in South Carolina; occurs in mixed mesic forest in the Tugaloo River Composite watershed **Outside of known range**	--	--	M
RELICT TRILLIUM *Trillium reliquum*	Federally Endangered	Basic mesic forests in Savannah and Chattahoochee drainages; known from the lower piedmont/fall line sandhills region **Outside of known range**	--	--	P
SMOOTH CONEFLOWER *Echinacea laevigata*	Federally Endangered	Occurs along the Brevard Geologic Belt in association with grassy understories and open canopies **Outside of known range**	--	--	M
WOOD STORK *Mycteria americana*	Federally Threatened	Known to forage in freshwater wetlands on both Enoree and Long Cane Ranger Districts **Potential habitat occurs within project area**	--	+	P
FLORIDA GOOSEBERRY *Ribes echinellum*	Federally Threatened	Known from the Stevens Creek drainage, on north facing hardwood slopes in association with basic soils **Outside of known range**	--	--	P
SMALL WHORLED POGONIA *Isotria medeoloides*	Federally Threatened	Occurs in mixed mesic forests at moderate elevations (>1,000 feet) **Outside of known range**	--	--	M
ASHLEAF GOLDENBANNER *Thermopsis mollis* var. *fraxinifolia*	Sensitive	Pine-oak heaths and roadsides **Outside of known range**	--	--	M
BACHMAN'S SPARROW *Aimophila aestivalis*	Sensitive	Occurs in forest stands with open canopies and grassy understories **Not known to occur within project area**	--	--	P
BALD EAGLE *Haliaeetus leucocephalus*	Sensitive	Perennial rivers and lakes, nesting in dominant or co-dominant pines 3 km or less from open water **Known to occur immediately adjacent to project area**	+	+	P, M
BILTMORE SEDGE *Carex biltmoreana*	Sensitive	Thin soils on rock outcrops and adjacent woodlands; known from the Chattooga River Corridor **Outside of known range**	--	--	M

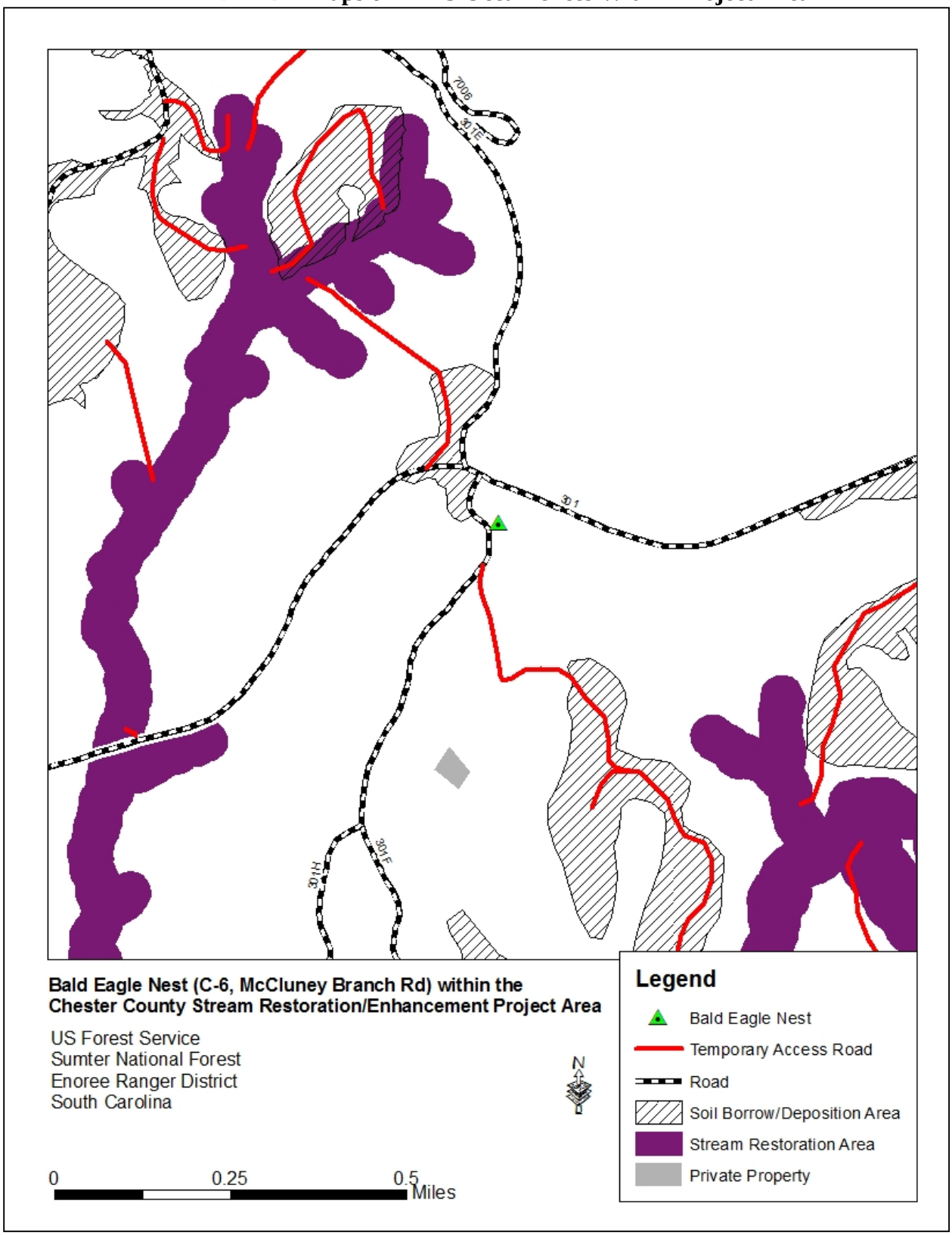
Proposed, Endangered, Threatened, and Sensitive (PETS) Species of the Sumter National Forest (2014). Obs = Observed during field surveys or known to occur based on previous records; Hab = Suitable habitat exists within the project area; "+" = meets criterion, "--" = does not meet criterion. P = piedmont (Enoree and Long Cane Ranger Districts), M = mountains (Andrew Pickens Ranger District).					
Species	**Status**	**Habitat Description / Reason for Including In or Excluding From Analysis**	**Obs**	**Hab**	**Range**
BROOK FLOATER *Alasmidonta varicosa*	Sensitive	Small streams with gravel bottoms; known from Chattooga, Turkey and Upper Stevens Creek watersheds on the Long Cane Ranger District **Outside of known range**	--	--	P, M
BUTTERNUT *Juglans cinerea*	Sensitive	Basic mesic forests along the Brevard Geologic Belt; usually at old homesites **Outside of known range**	--	--	M
CAROLINA DARTER *Etheostoma collis*	Sensitive	Localized populations occur in lower and middle piedmont streams with slow to moderate current. Known from Saluda and Broad River watersheds **Not known to occur within project area**	--	--	P
CAROLINA PLAGIOMNIUM *Plagiomnium carolinianum*	Sensitive	Damp, shaded, vertical rock faces along streams in mountain gorges; known from Long Creek and Opossum Creek **Outside of known range**	--	--	M
CHAUGA CRAYFISH *Cambarus chaugaensis*	Sensitive	Fast-moving, rocky 3rd and 4th order streams in tributaries of the upper Savannah River; known most recently from the Chauga River; noted historically in Ramsey Creek, West Village Creek, Crane Creek, Cedar Creek, and a stream between Long Creek and the Chattooga River (1972 data) **Outside of known range**	--	--	M
DIANA FRITILLARY *Speyeria diana*	Sensitive	Violets are larval host plant; open areas for nectar sources in summer **Outside of known range**	--	--	M
EASTERN SMALL-FOOTED MYOTIS *Myotis leibii*	Sensitive	At southern terminus of range on Andrew Pickens Ranger District; known from Moody Creek near Lake Cherokee; may commonly roost in hemlock trees near streams in summer **Outside of known range**	--	--	M
EDMUND'S SNAKETAIL *Ophiogomphus edmundo*	Sensitive	Clear moderately flowing mountain streams and rivers with sand or gravel riffles; known to occur in the Chattooga River **Outside of known range**	--	--	M
FORT MOUNTAIN SEDGE *Carex communis* var. *amplisquama*	Sensitive	Found in rich coves, at Tamassee Knob, East Fork of the Chattooga, and White Rock Cove on the Andrew Pickens Ranger District **Outside of known range**	--	--	M
FRASER'S LOOSESTRIFE *Lysimachia fraseri*	Sensitive	Open stands or rights-of-way with grassy understories **Outside of known range**	--	--	M

Proposed, Endangered, Threatened, and Sensitive (PETS) Species of the Sumter National Forest (2014). Obs = Observed during field surveys or known to occur based on previous records; Hab = Suitable habitat exists within the project area; "+" = meets criterion, "--" = does not meet criterion. P = piedmont (Enoree and Long Cane Ranger Districts), M = mountains (Andrew Pickens Ranger District).					
Species	**Status**	**Habitat Description / Reason for Including In or Excluding From Analysis**	**Obs**	**Hab**	**Range**
GEORGIA ASTER *Symphyotrichum georgianus*	Sensitive; Federal Candidate	Open stands or rights-of-way with grassy understories; piedmont and lower elevations in mountains **Known to occur within project area**	+	+	P, M
HARTWIG'S LOCUST *Robinia viscose* var. *hartwegii*	Sensitive	Pine-oak heaths and roadsides in the mountains; one location known near Village Creek on the Andrew Pickens Ranger District **Outside of known range**	--	--	M
INDIGO BUSH *Amorpha schwerini*	Sensitive	Pine-oak heaths and oak-hickory communities **Not known to occur within project area; potential habitat exists**	--	+	P
JEWELED TRILLIUM *Trillium simile*	Sensitive	Basic mesic forests of the mountains **Outside of known range**	--	--	M
LANCELEAF TRILLIUM *Trillium lancifolium*	Sensitive	Basic mesic forests of the piedmont **Not known to occur within project area; potential habitat exists**	--	+	P
LIVERWORT SP. *Cheilolejeunea evansii*	Sensitive	Bark of trees in moist escarpment gorges or gorge-like habitats **Outside of known range**	--	--	M
LIVERWORT SP. *Plagiochila caduciloba*	Sensitive	Found on damp, shaded, vertical rock faces along streams in mountain gorges; southern appalachian endemic **Outside of known range**	--	--	M
LIVERWORT SP. *Plagiochila sharpii*	Sensitive	Found on damp, shaded, vertical rock faces along streams in mountain gorges **Outside of known range**	--	--	M
LIVERWORT SP. *Radula sullivantii*	Sensitive	Wet shaded rocks and crevices **Outside of known range**	--	--	M
MIGRANT LOGGERHEAD SHRIKE *Lanius ludovicia migrans*	Sensitive	Breeds in open areas dominated by grasses interspersed with shrubs, trees, or bare ground; uses agricultural landscapes (pastures) **Not known to occur within project area**	--	--	P
MOUNTAIN WITCH ALDER *Fothergilla major*	Sensitive	Occurs in oak-hickory forests; may occur on monadnocks or north-facing slopes in piedmont **Outside of known range**	--	--	M
NODDING TRILLIUM *Trillium rugelii*	Sensitive	Rich wooded slopes over mafic or calcareous rocks **Not known to occur within project area; potential habitat exists**	--	+	P, M
OGLETHORPE OAK *Quercus oglethorpensis*	Sensitive	Upland wetland depressions and streamside forests in the Carolina Slate belt **Not known to occur within project area**	--	--	P

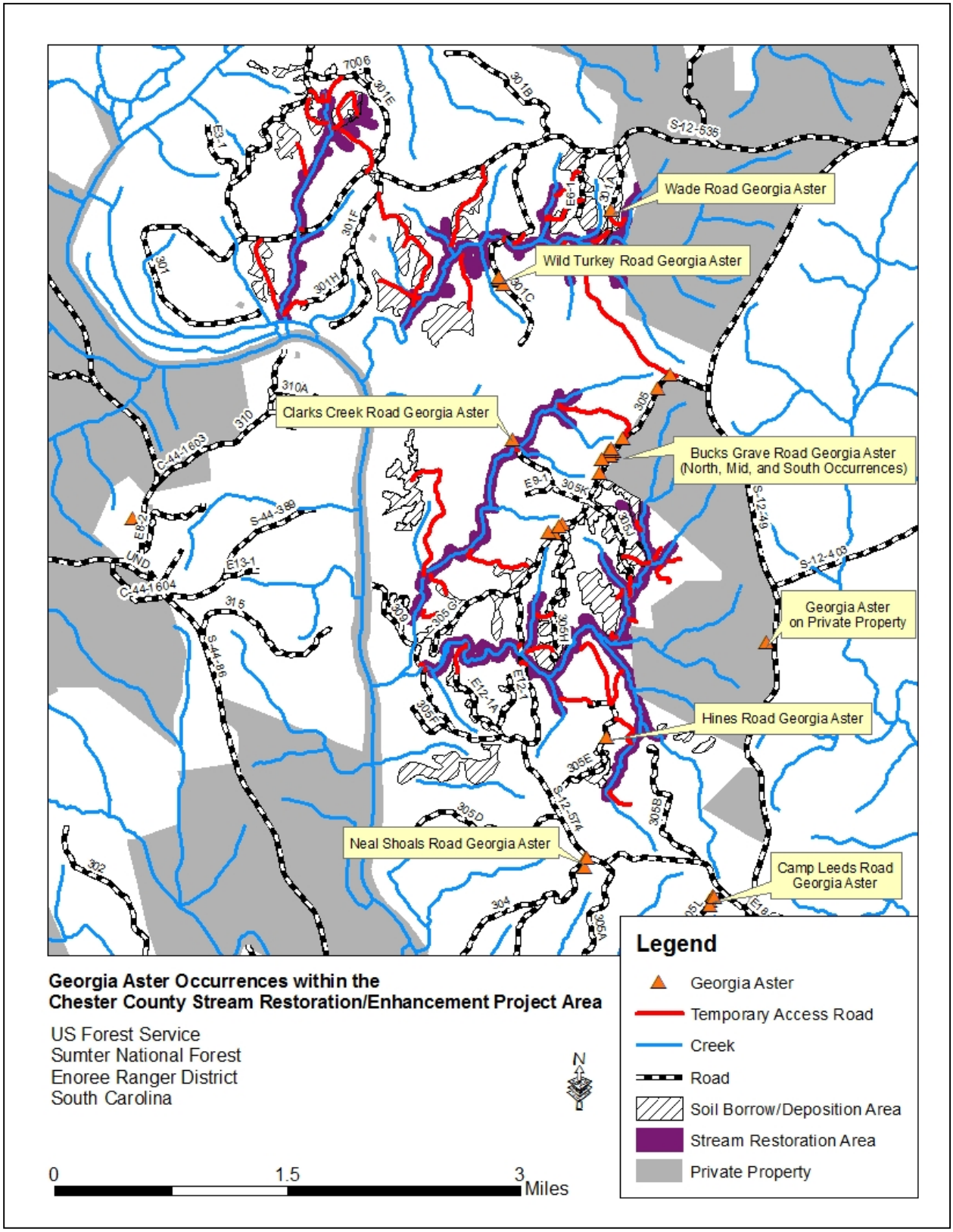
Proposed, Endangered, Threatened, and Sensitive (PETS) Species of the Sumter National Forest (2014). Obs = Observed during field surveys or known to occur based on previous records; Hab = Suitable habitat exists within the project area; "+" = meets criterion, "--" = does not meet criterion. P = piedmont (Enoree and Long Cane Ranger Districts), M = mountains (Andrew Pickens Ranger District).					
Species	**Status**	**Habitat Description / Reason for Including In or Excluding From Analysis**	**Obs**	**Hab**	**Range**
PIEDMONT or **BOUQUET ASTER** *Eurybia mirabilis*	Sensitive	Nutrient-rich bottomlands and moist slopes, endemic to the NC and SC piedmont **Not known to occur within project area; potential habitat exists**	--	+	P
PIEDMONT STRAWBERRY *Waldsteinia lobata*	Sensitive	Occurs in mixed mesic hardwood forests in the lower elevations of the mountains **Outside of known range**	--	--	M
RADFORD'S SEDGE *Carex radfordii*	Sensitive	Occurs in basic mesic and mixed mesic hardwood forests **Outside of known range**	--	--	M
RAFINESQUE'S BIG-EARED BAT *Corynorhinus rafinesquii*	Sensitive	Restricted to the mountains, sandhills, and coastal plain Physiographic regions; may be found in hollow trees or behind loose bark near streams, caves, mines, or human-made structures **Outside of known range**	--	--	M
RAYED PINK FATMUCKET *Lampsilis splendida*	Sensitive	Primarily a coastal plain species; one occurrence in Middle Saluda River Composite watershed **Not known to occur within project area**	--	--	P
ROBUST REDHORSE *Moxostoma robustrum*	Sensitive	Occurs in the Lower Savannah River composite watershed and introduced to the Broad River **Not known to occur within project area**	--	--	P
SHOAL'S SPIDER LILY *Hymenocallis coronaria*	Sensitive	Rocky river shoals; sandhills and piedmont **Not known to occur within project area**	--	--	P
SOUTHERN APPALACHIAN SALAMANDER *Plethodon teyahalee*	Sensitive	Mature mesic hardwood forests **Outside of known range**	--	--	M
SOUTHERN OCONEE BELLS *Shortia galacifolia* var. *galacifolia*	Sensitive	Large colonies in mixed mesic forests near Lake Jocassee **Outside of known range**	--	--	M
SPREADING POGONIA *Cleistes bifaria*	Sensitive	Dry ridgetops under pines **Outside of known range**	--	--	M
SUN-FACING CONEFLOWER *Rudbeckia heliopsidis*	Sensitive	Open forests with herbaceous understories; known from roadsides in the vicinity of Lake Cherokee **Outside of known range**	--	--	M
SWEET PINESAP *Monotropsis odorata*	Sensitive	Shortleaf pine-oak heaths in the southern Appalachians and piedmont **Not known to occur within project area; potential habitat exists**	--	+	P, M

Proposed, Endangered, Threatened, and Sensitive (PETS) Species of the Sumter National Forest (2014). Obs = Observed during field surveys or known to occur based on previous records; Hab = Suitable habitat exists within the project area; "+" = meets criterion, "--" = does not meet criterion. P = piedmont (Enoree and Long Cane Ranger Districts), M = mountains (Andrew Pickens Ranger District).					
Species	**Status**	**Habitat Description / Reason for Including In or Excluding From Analysis**	**Obs**	**Hab**	**Range**
WEBSTER'S SALAMANDER *Plethodon websteri*	Sensitive	Mesic hardwood slopes with rocky outcrops; Greenwood, Edgefield, and McCormick Counties **Not known to occur within project area**	--	--	P
WHORLED HORSEBALM *Collinsonia verticillata*	Sensitive	Found in basic mesic forests along the Brevard Geologic Belt in South Carolina **Outside of known range**	--	--	M

APPENDIX B – Maps of PETS Occurrences Within Project Area



Map 1. Bald eagle nest near McCluney Branch Road (FS Road 301H)



Map 2. Georgia aster occurrences within the project area

APPENDIX C - COMMENT LETTERS IN CHRONOLOGICAL ORDER

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
SAM NUNN
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA GEORGIA 30303-8960

September 30, 2014

Mr. John Richard Lint
Forest Supervisor
Chester County Stream and Riparian
Restoration/Enhancement Project
4931 Broad River Road
Columbia, South Carolina 29212

SUBJECT: Draft Environmental Impact Statement, Chester County Stream and Riparian Restoration/Enhancement Project, Sumter National Forest, Chester County, S.C. CEQ No.: 20140263

Dear Mr. Lint:

The U.S. Environmental Protection Agency (EPA) Region 4 Office has received and reviewed the subject document and is commenting in accordance with Section 309 of the Clean Air Act (CAA) and Section 102(2)(C) of the National Environmental Policy Act (NEPA). The Draft Environmental Impact Statement (DEIS) proposes to restore and enhance the hydrologic and aquatic functions of approximately 18 miles of streams within four Sumter National Forest watersheds in Chester County, S.C.

The U.S. Forest Service (USFS) evaluated two alternatives, including the No Action alternative. The proposed action alternative includes the primary restoration and enhancement activities of floodplain reconnection, floodplain excavation, floodplain transitions, floodplain benches and planting native trees, shrubs and herbaceous vegetation. EPA notes that the Forest Management Plan will require an amendment for the proposed action. The four (4) streams that would be addressed through this proposed action include Clarks Creek, Little Turkey Creek, McCluney Branch, and an unnamed tributary to Clarks Creek.

The DEIS identifies that timber harvesting will also be conducted as part of the stream restoration and enhancement project. EPA could not identify in the DEIS how much timber is being harvested from soil borrow and stream restoration areas and notes the estimated value for timber in Table 3-31, page 173. EPA requests that this information be provided in the Final EIS. Approximately 13 miles of temporary roads would also be constructed as part of the proposed action. Due to the extent of soil disturbance for this proposed action, the introduction of aggressive non-native invasive species (e.g., Japanese knotweed, Chinese privet, etc.) is a potential long-term concern that should be addressed to meet the project's wildlife habitat enhancement goals. EPA requests that the most stringent Best Management Practices (BMPs) be employed during and after construction activities including periodic monitoring and annual eradication treatments for non-native invasive species, as necessary.

EPA notes the 'mitigation measures' being proposed in Section 2.4 of the DEIS, including erosion and sediment control measures for water quality, aquatic organism re-introduction, rare plant communities and future old growth remnants, proposed, threatened and sensitive species, and scenic and recreation. For water quality impacts associated with the proposed action, the USFS is proposing to minimize soil runoff into streams by strict adherence to numerous soil erosion and sediment control measures, streams would be diverted and pumped around active construction areas when needed to reduce work in flowing water, and repairs for in-channel work may require the use of low ground pressure equipment or mats to access problem areas. The USFS proposes aquatic species re-introduction in at least one project stream immediately following restoration and in the remaining streams if 2 years of monitoring indicates low species diversity and density. Rare plant communities and future old growth remnants are planned to be avoided by the USFS to the extent possible. Measures to minimize potential impacts to the Bald Eagle nests and communal roost sites and Georgia Aster sites are also described in the DEIS. EPA supports these avoidance and minimization measures and requests that they be included as environmental project commitments in the Record of Decision.

Based upon our review of the DEIS, we have rated the document as 'lack objections', or "LO", which indicates that we do not have any substantial environmental concerns for the proposed action as described. Please address the proposed avoidance and minimization measures in the Final EIS. Please forward a copy of the Final EIS for our review and comment when it becomes available. Should you have any questions concerning our review comments, please contact Mr. Christopher Militscher of my staff at 404-562—9512 or by e-mail at Militscher.chris@epa.gov.

Sincerely,

Heinz J. Mueller, Chief
NEPA Program Office

South Carolina Department of
Natural Resources

1000 Assembly Street Suite 336
PO Box 167
Columbia, SC 29202
803.734.3282 Office
803.734.9809 Fax
mixong@dnr.sc.gov

Alvin A. Taylor
Director
Robert D. Perry
Director, Office of
Environmental Programs

October 15, 2014

Chester County Stream and Riparian Restoration/Enhancement Project
Francis Marion and Sumter National Forests
4931 Broad River Road
Columbia, South Carolina 29212

ATTN: John Richard Lint, Forest Supervisor

REFERENCE: Draft Environmental Impact Statement, Chester County Stream and Riparian Restoration/Enhancement Project

Dear Mr. Lint:

Personnel with the South Carolina Department of Natural Resources (DNR) have reviewed the Draft Environmental Impact Statement (DEIS) for the Chester County Stream and Riparian Restoration/Enhancement Project and offer the following comments.

The proposed project area is bounded by the Broad River to the west and SC Highway 49 to the east. The project area includes four watersheds (Clarks Creek, Little Turkey Creek, McCluney Branch and an unnamed tributary to Clarks Creek) located in the Woods Ferry Area of the Enoree Ranger District within Sumter National Forest in Chester County. The existing condition of the four watersheds is described in the DEIS as Piedmont stream valleys covered with legacy sediments in depths up to several meters. Streams and wetlands within the project area that were once pristine reflect past land management practices that have led to deteriorated conditions and reduced stream function. Streams are incised and disconnected from an active floodplain, which exasperates in-stream channel erosion and down-cutting and substantially limits the hydrologic, physical, chemical, and biological functions of the streams.

The DEIS evaluates two alternatives, a no-action alternative (Alternative 1) and the proposed action (Alternative 2). The proposed action would restore and enhance the hydrologic, riparian, and aquatic functions on approximately 18 miles of streams within the four watersheds that comprise the project area. The proposed action would restore riparian functions, re-establish stream stability and enhance natural habitat-forming processes. The proposed action includes, but is not limited to, restoring the hydrologic regime by reconnecting streams to their floodplains, reducing sedimentation and stabilizing banks, improving in-stream and riparian

habitats, and improving water quality. Restoration work would be accomplished through the use of Priority 1, 2 and 3 Rosgen stream restoration methods.

This DEIS evaluates the direct, indirect, and cumulative impacts of the alternatives and provides documentation for the proposed action to be considered for use as compensatory mitigation to offset the unavoidable stream and wetland impacts associated with the construction of a drought and operating contingency reservoir at Duke Energy William States Lee III Nuclear Station (Lee Nuclear Station) in Cherokee County.

DNR submits that the successful completion of the proposed action as presented in the DEIS will provide significant natural resource benefits and could offset the impacts associated with the Lee Nuclear Station. However, the determination of the adequacy of any Permittee-Responsible Mitigation (PRM) proposal for the Lee Nuclear Station will need to be evaluated under the 2008 Final Compensatory Mitigation Rule and the Charleston District Guidelines for Preparing a Compensatory Mitigation Plan. DNR looks forward to reviewing the PRM proposal upon submittal as well as any permits or other authorizations that may be required and we will provide more specific comments at that time.

Thank you for the opportunity to review this DEIS and provide comments. Should you have any questions or need more information, please do not hesitate to contact me by email at mixong@dnr.sc.gov or by phone at 803.734.3282.

Sincerely,

Greg Mixon
Inland Environmental Coordinator

ec: Richard Darden – ACE
Alicia Rowe – DHEC
Kelly Laycock – EPA
Christopher Evans – FS
Mark Caldwell – FWS
Jaclyn Daly – NMFS
Emily Dale - SHPO

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Richard B. Russell Federal Building
75 Spring Street, S.W.
Atlanta, Georgia 30303

ER 14/0592
9043.1

October 28, 2014

Francis Marion
Sumter National Forest All Units
4931 Broad River Road
Columbia, SC 29212-3530

Re: Comments on the Draft Environmental Impact Statement (DEIS) for US Forest Service (USFS), Chester County Stream and Riparian Restoration/Enhancement Project located in Sumter National Forest, Chester County, SC

Dear Ms. Marion:

The Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement (DEIS) for US Forest Service (USFS), Chester County Stream and Riparian Restoration/Enhancement Project located in Sumter National Forest. We have no comments at this time.

If you have questions or need further information, I can be reached on (404) 331-4524 or via email at joyce_stanley@ios.doi.gov.

Sincerely,

Joyce Stanley, MPA
Regional Environmental Protection Specialist

cc:
Jerry Ziewitz – FWS
Gary Lecain - USGS
Anita Barnett – NPS
OEPC – WASH

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APPENDIX D - RESPONSES TO COMMENTS RECEIVED DURING THE 45-DAY COMMENT PERIOD

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Chester County Stream and Riparian Restoration/Enhancement Project
Final Environmental Impact Statement Comment/Response Table

Comment Date	Commenter	Comment Summary	U.S. Forest Service Response
September 30, 2014	Environmental Protection Agency (EPA) Region 4 Heinz J. Mueller, Chief	EPA noted that the Draft Environmental Impact Statement (EIS) identified timber harvesting as part of the stream restoration and enhancement Project.	Yes, timber harvesting will occur as part of the Project.
		• EPA could not identify how much timber would be harvested from soil borrow and stream restoration areas in the Draft EIS. • EPA noted that an estimated value for timber was listed in Table 3-31, page 173 of the Draft EIS. • EPA requested this information be provided in the Final EIS.	U.S. Forest Service (Forest Service) provided a revised Table 3-31 to include timber harvest economics. Volume estimates have been added to the effects discussion.
		EPA requested the most stringent best management practices (BMPs) be employed during and after construction activities including periodic monitoring and annual eradication treatments for non-native invasive species, as necessary.	Forest Service will implement State and National BMPs as identified in Section 2.4 (**Mitigation Measures Common to All Action Alternatives)**.
		EPA supports the avoidance and minimization measures in the Draft EIS and requested they be included as environmental project commitments in the Record of Decision (ROD).	Forest Service included mitigation and monitoring as part of the Draft (ROD).
		EPA rated the document as “lack objections” which indicates that are no substantial environmental concerns for Alternative 2-Proposed Action as described.	Comment noted. No further action required.

Comment Date	Commenter	Comment Summary	U.S. Forest Service Response
October 15, 2014	South Carolina Department of Natural Resources (SCDNR) Greg Mixon, Inland Environmental Coordinator	SCDNR proposed that the successful completion of Alternative 2-Proposed Action as presented in the DEIS would provide significant natural resource benefits and could offset the impacts associated with the Lee Nuclear Station. However, the determination of the adequacy of any Permittee-Responsible Mitigation (PRM) proposal for the Lee Nuclear Station would be evaluated under the 2008 Final Compensatory Mitigation Rule and the Charleston District Guidelines for Preparing a Compensatory Mitigation Plan.	Forest Service agrees with SCDNR. Duke Energy LLC is working with the U.S. Army Corps of Engineers (USACE), Charleston District, regarding the Compensatory Mitigation Plan. USACE is also a cooperating agency on the EIS.
October 27, 2014	U.S. Department of the Interior, (DOI) Office of the Secretary Joyce Stanley, MPA Regional Environmental Protection Specialist	DOI reviewed the Draft EIS and had no comments.	Comment noted. No further action required.